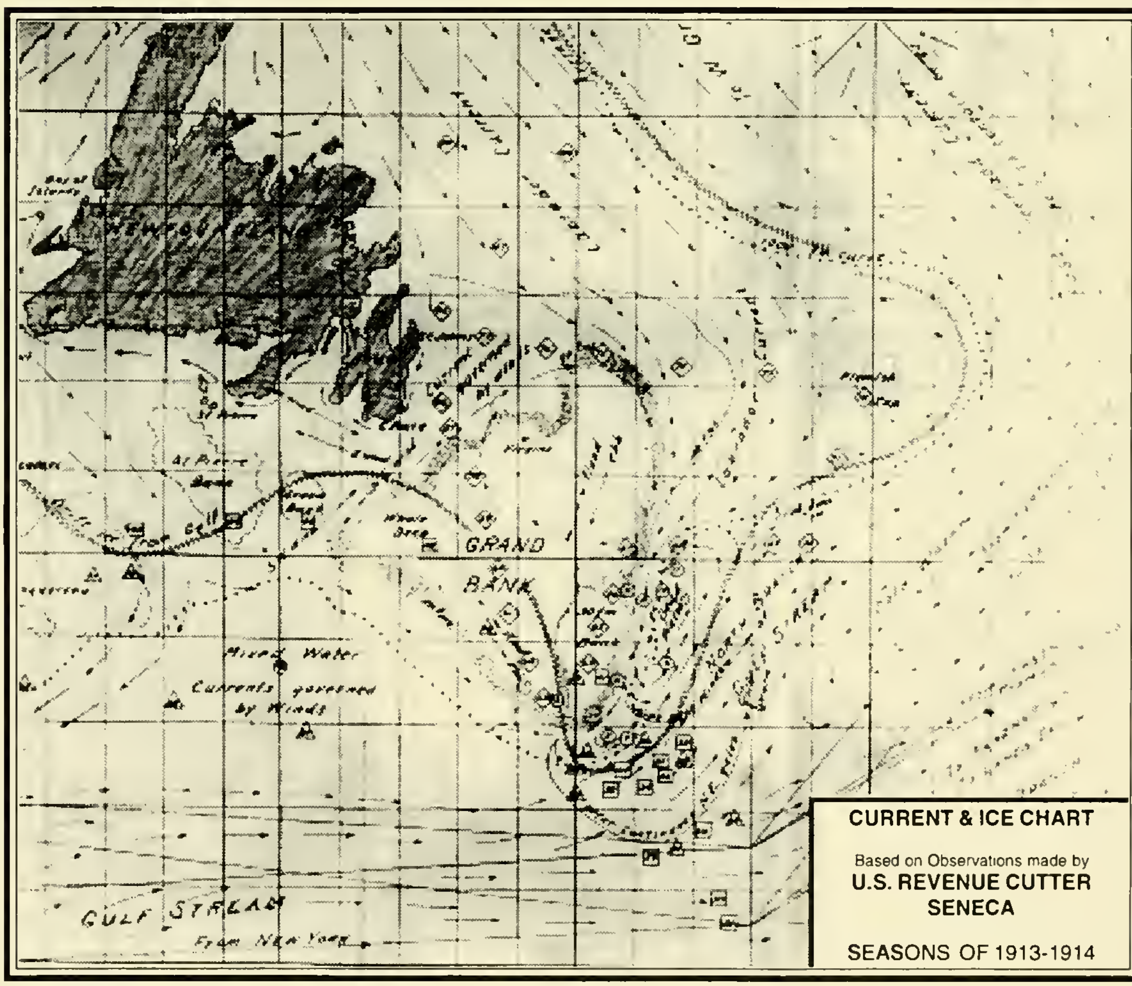
U. S. Department
of Transportation
**United States
Coast Guard**

Report of the International Ice Patrol in the North Atlantic



1997 Season
Bulletin No. 83
CG-188-52

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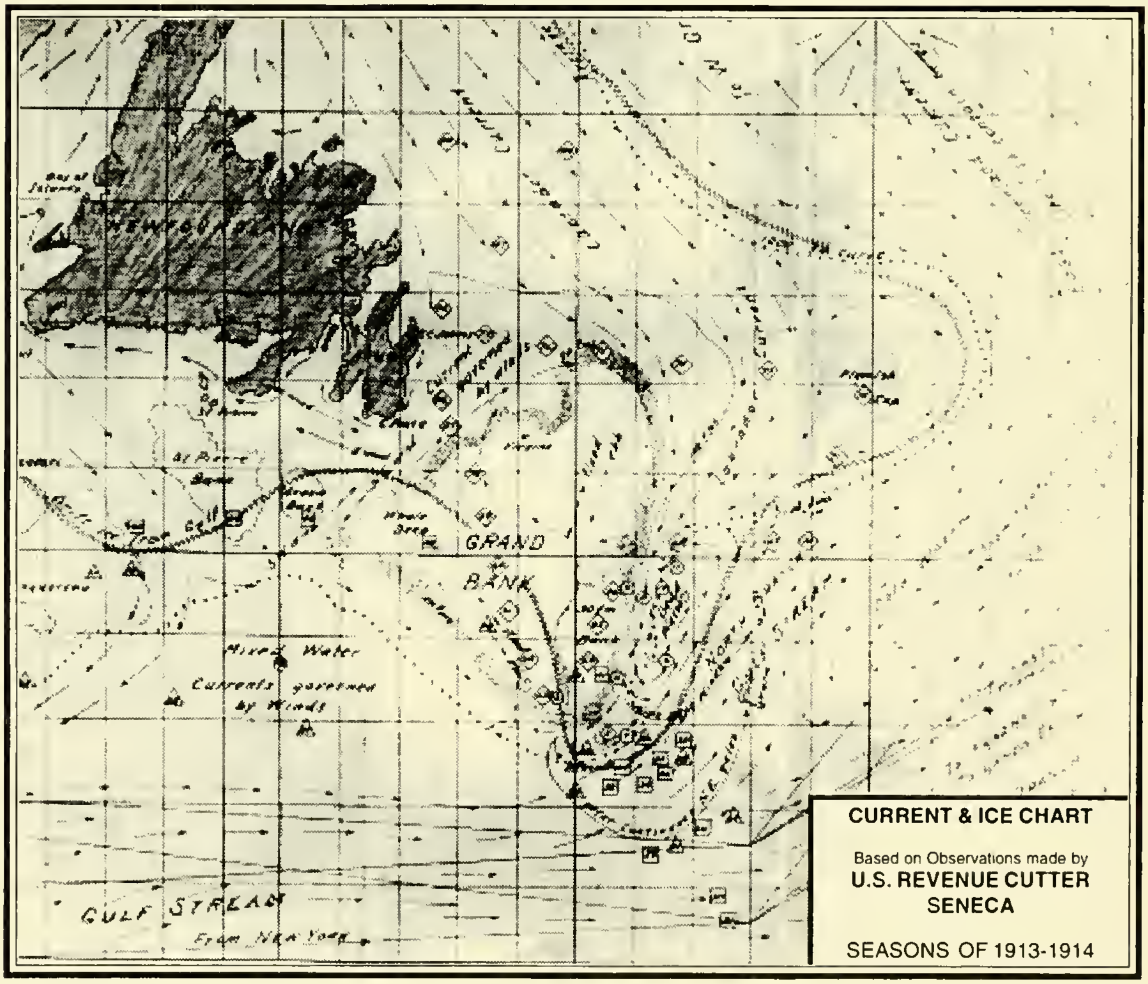

CURRENT & ICE CHART
Based on Observations made by
U.S. REVENUE CUTTER SENECA
SEASONS OF 1913-1914

1997 Season
Bulletin No. 83
CG-188-52

Bulletin No. 83

REPORT OF THE INTERNATIONAL ICE PATROL IN THE NORTH ATLANTIC

Season of 1997

CG-188-52

Forwarded herewith is Bulletin No. 83 of the International Ice Patrol, describing the Patrols's services, ice observations and conditions during the 1997 season.

E. R. RIUTTA
Rear Admiral, U. S. Coast Guard
Assistant Commandant for Operations

International Ice Patrol 1997 Annual Report

Contents

Introduction

This is the 83nd annual report of the International Ice Patrol (IIP). It contains information on Ice Patrol operations, environmental conditions, and ice conditions for the 1997 IIP season. The U.S. Coast Guard conducts the Ice Patrol in the North Atlantic under the provisions of U.S. Code, Title 46, Sections 738, 738a through 738d, and the International Convention for the Safety of Life at Sea (SOLAS), 1974. The IIP is supported by 17 member nations (Appendix A). It was initiated shortly after the sinking of the RMS TITANIC on April 15, 1912 and has been conducted yearly since that time.

Commander, International Ice Patrol (CIIP) is under the operational control of Commander, Coast Guard Atlantic Area. CIIP directs the Ice Patrol from its Operations Center in Groton, Connecticut. IIP receives iceberg location reports from ships and planes transiting its patrol area and conducts aerial Ice Reconnaissance Detachments (ICERECDETs) to survey the southeastern, southern, and southwestern regions of the Grand Banks of Newfoundland for icebergs. IIP analyzes ice and environmental data and employs an iceberg drift and deterioration model to produce twice-daily iceberg warnings, which are broadcast to mariners as ice bulletins and facsimile charts. IIP also responds to requests for iceberg information. IIP's ICERECDETs were based in St. John's, Newfoundland, Canada during the 1997 season.

The cover graphic shows the hand-drawn ice chart based on observations made by the U.S. Revenue Cutter SENECA during the ice seasons 1913 and 1914.

Vice Admiral Kent H. Williams was Commander, Atlantic Area until May, 1997, when he was relieved by Vice Admiral Roger T. Rufe, Jr. CDR Ross L. Tuxhorn was Commander, International Ice Patrol until July, 1997, when he was relieved by Commander Stephen L. Sielbeck.

Summary of Operations, 1997

The 1997 IIP year (October 1, 1996 - September 30, 1997) marked the 83nd anniversary of the International Ice Patrol, which was established February 7, 1914. IIP's operating area is enclosed by lines along 40°N, 52°N, 39°W and 57°W (Figure 1).

IIP's first preseason aerial ICERECDET of the year departed on January 26. The 1997 IIP season was opened on March 03 and from this date until July 31, 1997 an ICERECDET operated from Newfoundland approximately every other week. The season officially closed on August 14, 1997.

IIP's Operations Center in Groton, Connecticut analyzed the iceberg sighting information from the ICERECDETs, ships, Canadian Ice Services (CIS) sea ice/iceberg reconnaissance flights, and other sources. Air reconnaissance, consisting of Coast Guard (IIP), Other Air Recon, and CIS was the major source of iceberg sighting reports this season, accounting for 61.8% of the icebergs sighted in 1997 (Table 1). Ships provided 27.3% of the iceberg sightings received by IIP in 1997. Their continued active participation indicates the value that they place on IIP's service. In 1997, 285 ships of 45 different nations provided ice information to IIP. This demonstrates that the number of nations using IIP services far exceeds the 17 member nations underwriting IIP under SOLAS 1974. Appendix B lists the ships that provided iceberg sighting reports, including reports of stationary radar targets. In Appendix B, a single report may contain multiple targets.

The largest contributor of air reconnaissance reports was Provincial Airlines Limited (PAL). Their reports accounted for nearly all of the category "Other Air Recon" on Table 1. PAL is a private company that provides aerial reconnaissance services for the Canadian Department of Fisheries and Oceans (DFO) year round, and for CIS June through December. DFO flights, which are designated to monitor the activities of fishing vessels, frequently carry them to areas with

Table 1
Sources of All Sightings Entered into IIP's Drift Model

Sighting Source	Percent of Total
Coast Guard (IIP)	19.0
Other Air Recon	35.2
Canadian AES	7.6
BAPS	10.9
Ships	27.3

Table 2
Initial Sighting Sources of Limit-Setting Icebergs

Sighting Source	Percent of Total
Coast Guard (IIP)	41
Other Air Recon	21
Canadian AES	2
BAPS	6
Ships	18
National Ice Center	9
Other	3

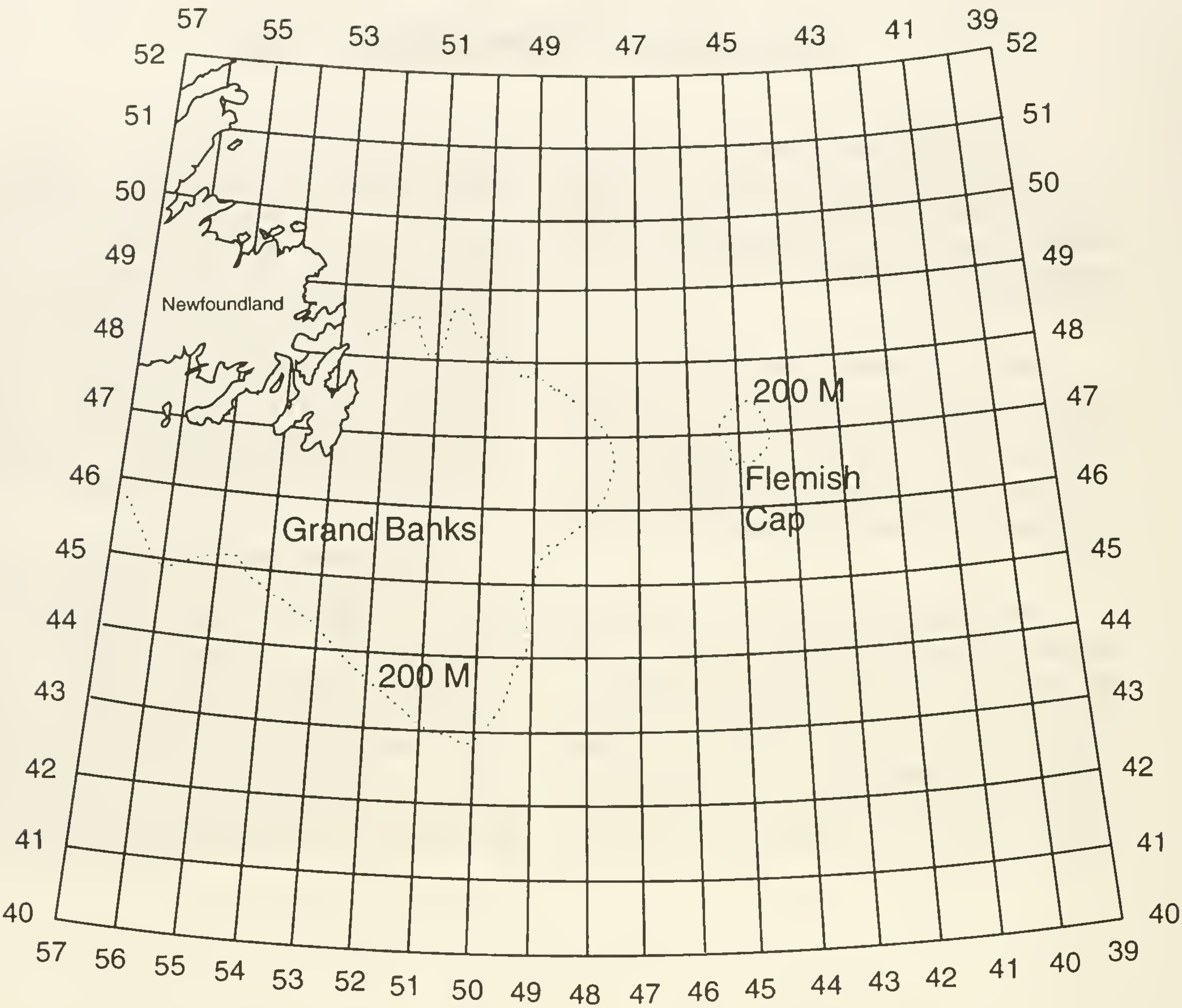

Figure 1
International Ice Patrol's Operation Area showing bathymetry of the Grand Banks of Newfoundland

high iceberg concentrations. The next largest contribution to the air reconnaissance total was from IIP ICERECDETs. IIP flights concentrate on defining the boundaries of the iceberg distribution. These are typically areas of low iceberg concentration. Table 2 shows the important contribution of IIP reconnaissance in determining the limits of all known ice (LAKI). The attributes of the individual icebergs that set the LAKI are described in Appendix C. BAPS sightings are icebergs detected north of 52°N primarily by CIS reconnaissance. These are passed to IIP by CIS when icebergs are predicted to have crossed into the Ice Patrol operating area. CIS provided IIP with iceberg information obtained during sea ice reconnaissance flights and a few flights dedicated solely to iceberg reconnaissance.

During 1997, the IIP Operations Center received a total of 4829 target sightings within its operations area which were entered into IIP's drift model. This is about 20% more than the 3902

target sightings during 1996. The 4829 targets entered into IIP's drift model do not represent all of the targets reported to IIP. Sightings of targets outside IIP's Area of Responsibility (AOR) were not entered into the model. Most of these were far to the north of IIP's AOR, in areas not covered by IIP's model. Coastal iceberg sightings were also screened, and only those with the potential to drift into the trans-Atlantic shipping lanes were entered into the IIP model.

Table 3 includes icebergs detected south of 48°N plus the number of icebergs which were predicted to have drifted across 48°N for each month of 1997. During the 1997 ice year, an estimated 1011 icebergs drifted south of 48°N; whereas, during 1996, 611 icebergs had drifted south of 48°N.

Table 3
Number of Icebergs South of 48°N

Number of Icebergs South of 48°N during 1997

Month	Number
OCT	0
NOV	0
DEC	0
JAN	0
FEB	10
MAR	475
APR	162
MAY	238
JUN	80
JUL	43
AUG	3
SEP	0
Total	1011

IIP classifies the severity of the ice seasons based on the historic iceberg counts of its entire 83 year history. Ice years with fewer than 300 icebergs crossing 48°N are defined as light ice years; those with 300 to 600 crossing 48°N as moderate; and those with more than 600 crossing 48°N as extreme. Thus, 1997 was in the "extreme" classification, but was an average year for iceberg conditions compared to the SLAR years of 1983-97 where the average is 1093.

The 1997 season was the fifth year that IIP used its iceberg Data Management and Prediction System (DMPS). This system, which is nearly identical to the iceBerg Analysis and Prediction System (BAPS) used at the Canadian Ice Centre, Ottawa, combines an iceberg drift model with a deterioration model. The drift model uses wind, ocean current, and iceberg size data to predict the movement of all icebergs entered into DMPS. This model uses a new historical current data base (Murphy, Viekman and Channel, 1996), which is modified weekly using satellite-tracked ocean drifting buoy data, thus taking into account local, short-term, current fluctuations. Murphy and Anderson (1985) described and evaluated the drift model. The iceberg deterioration model uses daily sea surface temperature and wave height information from the U.S. Navy Fleet Numerical Meteorology and Oceanography Center (FNMOC) to predict the melt of icebergs. Anderson (1983) and Hanson (1987) described the IIP deterioration model in detail.

In Ice Season 1998, IIP will use the Iceberg Data Management and Prediction System (IDMPS). IDMPS will run on a faster UNIX system which will interface with a Windows NT based Geographical Information System (GIS) in order for IIP to more efficiently process and predict iceberg drift and deterioration information. The fundamental aspects of the model will not change.

Thirteen satellite-tracked ocean drifting buoys were deployed to provide current data for

IIP's iceberg drift model during the 1997 season. The buoys are similar in design to the World Ocean Circulation Experiment (WOCE) and were equipped with surface temperature sensors and a drogue centered at 50 meters. The data were distributed in near real time via the Global Telecommunications System. Drift data from the buoys are presented in the IIP 1997 Drifting Buoy Atlas, which is available upon request. IIP also provided weekly drifting buoy sea surface temperature (SST) and drift histories to the Canadian Meteoological and Oceanographic Centre (METOC) in Halifax, Nova Scotia and the U.S. Naval Atlantic Meteorology and Oceanography Center (NLMOC) in Norfolk, Virginia for use in water mass and SST analyses.

During the 1997 season, IIP successfully deployed 170 Air-deployable eXpendable BathyThermographs (AXBTs), which measure temperature with depth and transmit the data back to the aircraft. Temperature data from the AXBTs were sent to the METOC Halifax, NLMOC, and FNMOC for use as inputs into ocean temperature models.

The AXBTs are deployed as part of a cooperative program between Canadian Meteorological Centre (CMC)/METOC,which provides the probes, and IIP, which deploys the probes and distributes the data. This cooperation benefits both organizations. The temperature data improves the FNMOC products which are used in IIP's iceberg deterioration model and are a valuable source of information for METOC's regional oceanographic analysis.

On April 15, 1997, IIP paused to remember the 85th anniversary of the sinking of the RMS TITANIC. During an ice reconnaissance patrol, two wreaths were placed near the site of the sinking to commemorate the more than 1500 lives lost.

Iceberg Reconnaissance and Communications

During the 1997 Ice Patrol year, 112 aircraft sorties were flown in support of IIP. Of these, 54 were transit flights to St. John's, Newfoundland, IIP's base of operations and 54 were ice observation flights made to locate the southwestern, southern, and southeastern limits of icebergs. Four logistics flights were required to support and maintain the patrol aircraft. Tables 4 and 5 show aircraft use for the 1997 ice year.

IIP's aerial ice reconnaissance was conducted with radar equipped U.S. Coast Guard HC-130H aircraft. The HC-130H aircraft used on Ice Patrol are based at Coast Guard Air Station Elizabeth City, North Carolina. Although they were not used in 1997, IIP has used HU-25B aircraft in past years. These aircraft are stationed at Air Station Corpus Christi, Texas and are available for use. However, the areal extent of the iceberg distribution in 1997 required the use of the long range HC-130H aircraft.

Since the Grand Banks region is very oceanographically and meteorologically dynamic, the visibility is notoriously poor. Therefore, IIP relies heavily on the AN/APS-135 Side Looking Airborne Radar (SLAR) and the AN/APS-137 Forward Looking Airborne Radar (FLAR). SLAR is the primary detection sensor while FLAR is the primary identification sensor, providing the ability to distinguish targets as icebergs or vessels. These sensors allow IIP aircraft to use a 30 nautical mile track spacing when searching for icebergs. Details on SLAR are in Robe et al. (1985) while details on FLAR are in Trivers and Murphy (1995).

IIP schedules aerial iceberg surveys every other week rather than every week. This

Table 4
Aircraft Usage During the 1997 Ice Year

Sorties

Transit	Patrol	Research	Logistics	Total
54	54	0	4	112

Flight Hours

Transit	Patrol	Research	Logistics	Total
141.8	319.9	0	19.6	481.3

Table 5
Iceberg Reconnaissance Sorties

Month	Sorties	Flight Hours
JAN	1	3.6
FEB	1	7.0
MAR	10	61.1
APR	12	64.8
MAY	11	70.6
JUN	10	52.5
JUL	9	60.3
TOTAL	**54**	**319.9**

is due to the ability of the SLAR and FLAR to detect and differentiate icebergs in all weather, combined with use of the iceberg drift and deterioration computer model to track icebergs in-between sightings.

Both the number of flight hours and sorties were greater in 1997 than in 1996. The total number of flight hours increased from 449.1 hours in 1996 to 483.1 in 1997. The number of sorties increased from 103 in 1996 to 112 in 1997. These increases reflect the greater extent of the geographic limits of the icebergs to the east of Flemish Cap and the Grand Banks during 1997.

Each day during the ice season IIP prepared and distributed ice bulletins at 0000Z and 1200Z to warn mariners of the southwestern, southern, and southeastern limits of icebergs. U. S. Coast Guard Communications Station Boston, Massachusetts, NMF/NIK, and Canadian Coast Guard Radio Station St. John's Newfoundland/VON were the primary radio stations responsible for the dissemination of the ice bulletins. In addition, the ice bulletins and safety broadcasts were delivered over the INMARSAT-C SafetyNet via the AOR-W satellite. Other transmitting stations for the bulletins included METOC Halifax, Nova Scotia/CFH, Canadian Coast Guard Radio Station Sydney/VCO, and Radio Station Bracknel, UK/GFE.

IIP also prepared a daily facsimile chart, depicting the limits of all known ice, for broadcast at 1600Z and 1810Z daily. In addition, the facsimile chart was placed on Comsat Corp's INMARSAT-A FAXMAIL Server for receipt at sea. U. S. Coast Guard Communications Area Master Station Atlantic/NMN assisted with the transmission of these charts. Canadian Coast Guard Radio Station St. John's Newfoundland/VON and U. S. Coast Guard Communications Area Master Station Atlantic/NMN also provided special broadcasts as required.

As in previous years, International Ice Patrol requested that all ships transiting the area of the Grand Banks report ice sightings, weather, and sea surface temperatures via Canadian Coast Guard Radio Station St. John's/VON, U. S. Coast Guard Communications Area Master Station Atlantic/NMN, or INMARSAT-C or -A using code 42. Response to this request is shown in Table 6. Appendix B lists all contributors. IIP received relayed information from the following sources during the 1997 ice year: Canadian Coast Guard Marine Radio Station St. John's/VON; Canadian Coast Guard Vessel Traffic Centre/Ice Operations St. John's; Ice Centre Ottawa; Canadian Coast Guard Marine Communication and Traffic Services Halifax, Nova Scotia/VCS; ECAREG Halifax, Nova Scotia; U. S. Coast Guard Communications Master Station Atlantic, Chesapeake, Virginia; U. S. Coast Guard Atlantic Area Command Center; and U. S. Coast Guard Automated Merchant

Table 6
Iceberg and Sea Surface Temperature (SST) Reports

Number of ships furnishing SST reports	72
Number of SST reports received	483
Number of ships furnishing ice reports	285
Number of ice reports received	864
First Ice Bulletin	031200Z MAR 97
Last Ice Bulletin	141200Z AUG 97
Length of Season (days)	165

Vessel Emergency Response/Operations Systems Center, Martinsburg, WV. Commander, International Ice Patrol extends a sincere thank you to all stations and ships which contributed reports. The vessel providing the most reports was the HMCS Montreal, a Canadian Forces vessel.

In addition, Ice Patrol receives land based lighthouse reports from stations along the coast of Newfoundland. The lighthouses providing these reports are listed in Table 7.

●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●

Table 7
Newfoundland Lighthouse Iceberg Reports

Bacalhao Lighthouse	14
Baccalieu Island Lighthouse	19
Bell Island Lighthouse	38
Belle Isle N.E. Lighthouse	28
Belle Isle S.W. Lighthouse	39
Camp Island Lighthouse	1
Gull Island Lighthouse	8
Kelly's Island Lighthouse	2
Surgeon's Cove Lighthouse	11
Twillingate Lighthouse	26
Total	186

Discussion of 1997 Ice Conditions

Background

This section presents a brief discussion of the sea ice and iceberg distribution prior to and during the 1997 season. While IIP monitors many environmental conditions near the Grand Banks, by far the two most important to iceberg population are the flow of the offshore branch of the Labrador Current and the distribution of sea ice.

The offshore branch of the Labrador Current is the main mechanism transporting icebergs south to the Grand Banks and the North Atlantic shipping lanes (Figure 2). Its relatively cold water keeps the deterioration of icebergs to a minimum. Ice Patrol uses satellite tracked drifters to monitor the variability in the Labrador current. The tracks of the 13 drifters used in 1997 are described in the Drifting Buoy Atlas which is available upon request.

Sea ice protects the icebergs from wave action, the major agent in iceberg deterioration. If sea ice extends to the south and over the Grand Banks of Newfoundland, the icebergs will be protected longer as they drift south. When the sea ice edge retreats in the spring, large numbers of icebergs may be left behind in the vicinity of the Grand Banks. If the time of retreat of the sea ice edge is delayed by below-normal air and sea surface temperatures, the icebergs will be protected from melt longer and be expected to survive to drift farther south. In these cases, a longer than normal ice season can be expected. Less southerly sea ice extent or above normal air and sea surface temperatures may result in a shorter season.

Sea ice can impede the transport of icebergs. The degree depends on the concentration of the sea ice and the size of the icebergs. The greater the sea ice concentration, the greater the effect on iceberg drift. The larger the iceberg, the less sea ice affects its drift.

The 1997 Season

Figures 3 to 10 compare the sea ice edge during the 1997 ice year to the mean sea ice edge. The mean sea ice edges were taken from Cote (1989) and represent a 25 year average (1962-1987). The ice edge (sea ice concentration $\geq 1/10$) is taken from the daily Ice Analysis from the Ice Centre, Ottawa.

Figures 11 to 21 show the Ice Patrol Limits of All Known Ice (LAKI) and the daily sea ice edge on the 15th and the last day of each month during the ice season. The ice edge is taken from the Ice Centre, Ottawa FICN2 daily product. The edge plotted is a coarse numeric representation of the daily Ice Analysis. These figures show the distribution of all icebergs and radar contacts tracked by IIP's model at the indicated times. Numerals are given for clarity for those one-degree squares where six or more targets were located.

The following is a discussion of the ice conditions, comparing those ice conditions observed and modeled in 1997 with the twenty-year IIP climatological LAKI described by Viekman and Baumer (1995).

December through February

Through December and January, sea ice growth along the Labrador coast and in East Newfoundland waters appeared to be slower

than normal (Figures 3-4). February and March showed a reversal in the preceding month's sea ice growth pattern (Figures 5-6). The sea ice extent exceeded normal conditions during this period and reached as far south as 46°N in the vicinity of the Grand Banks. At the end of February, 10 icebergs were south of 48°N. The reported LAKI (Figure 11) approximated the climatological median position for 15 March, thus triggering the start of the Ice Patrol Season on 3 March.

March

Throughout the month of March, a tongue of sea ice extended eastward to approximately 46°N, 47°W (similar to sea ice conditions of 1995), implying significant surface circulation towards the east (Figure 6). As seen with these conditions in the past, the reported LAKI positions for March (Figures 11-12) extended to an extreme eastward longitude of 39°W. There were 475 icebergs south of 48°N and the southern extent of the LAKI at the end of March was 42°N.

April

For the first half of the month, the eastern sea ice tongue receded, but remained extended to 49°N, 49°W (Figure 7). Later in the month, the sea ice rapidly melted and the edge receded toward the Labrador-Newfoundland coastlines. IIP's LAKI was reported near the 25th percentile climatological LAKI for the month of April (Figures 13-14). There were 162 icebergs south of 48°N in April.

May

Sea ice melting occured at a normal rate. However, remnants persisted along the coast of Newfoundland (Figure 8). The reported LAKI on 31 May (Figure 16) reached the 25th percentile to the east and the median climatological LAKI to the south. There were 238 icebergs south of 48°N in May.

June

The sea ice edge retreated above 52°N (Figures 9-10). The IIP LAKI (Figures 17-18) approximated the median climatological LAKI in the east and fell between the 75th percentile and the median to the south. There were 80 icebergs south of 48°N in June.

July

The reported LAKI (Figure 19) approximated the median climatological LAKI to the east reaching 44°W. To the south, the LAKI reached an extreme position of 41°30'N on 15 July. By 30 July, the LAKI had retreated to the median around 46°N. There were 43 icebergs south of 48°N in July (Figure 20).

August

The LAKI had retreated to 48°N by mid-August (Figure 21) while there were 3 icebergs south of 48°N. The Ice Patrol Season closed on 14 August.

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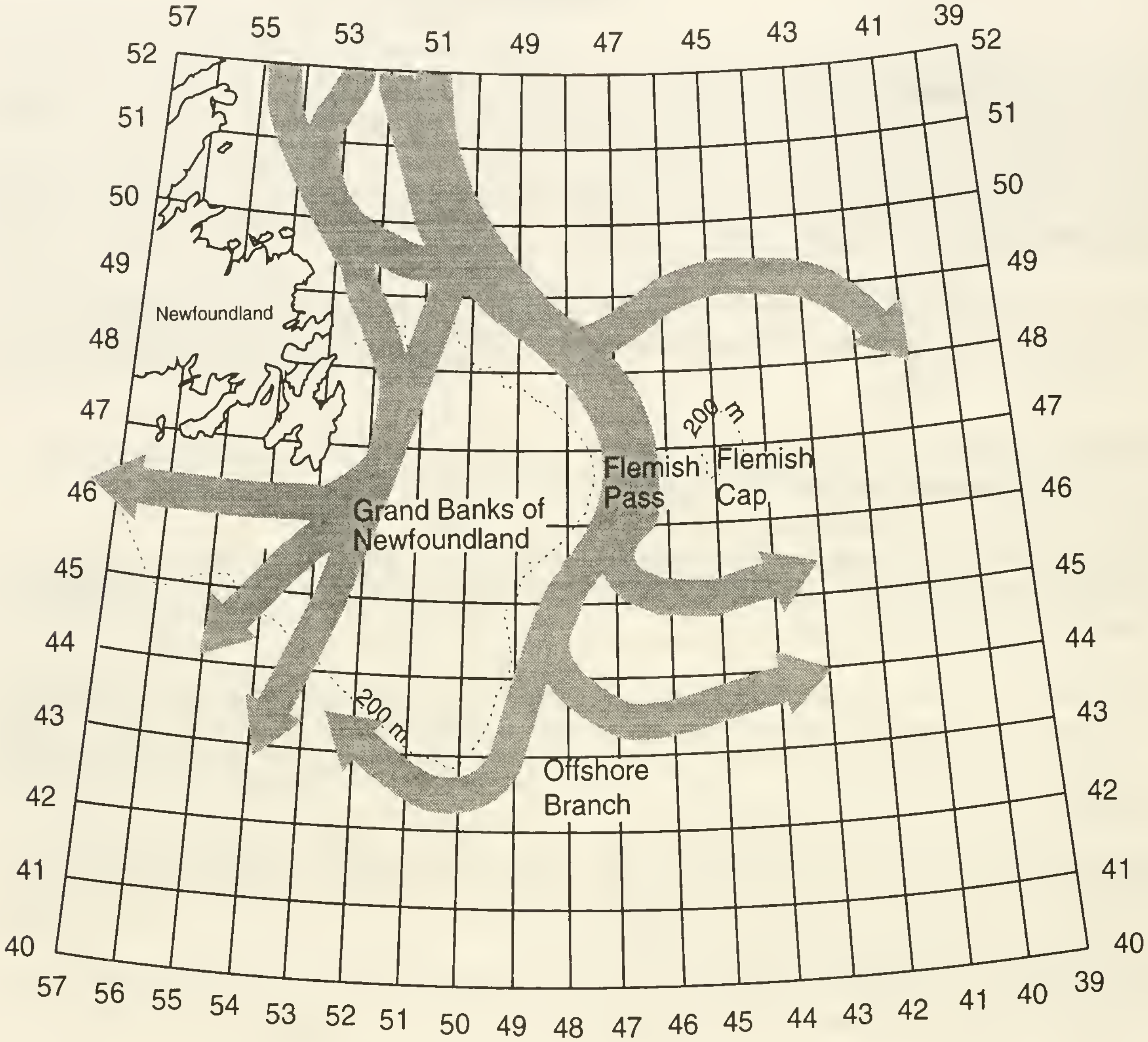


Figure 2
The Labrador Current, the main mechanism for transporting icebergs South to the Grand Banks

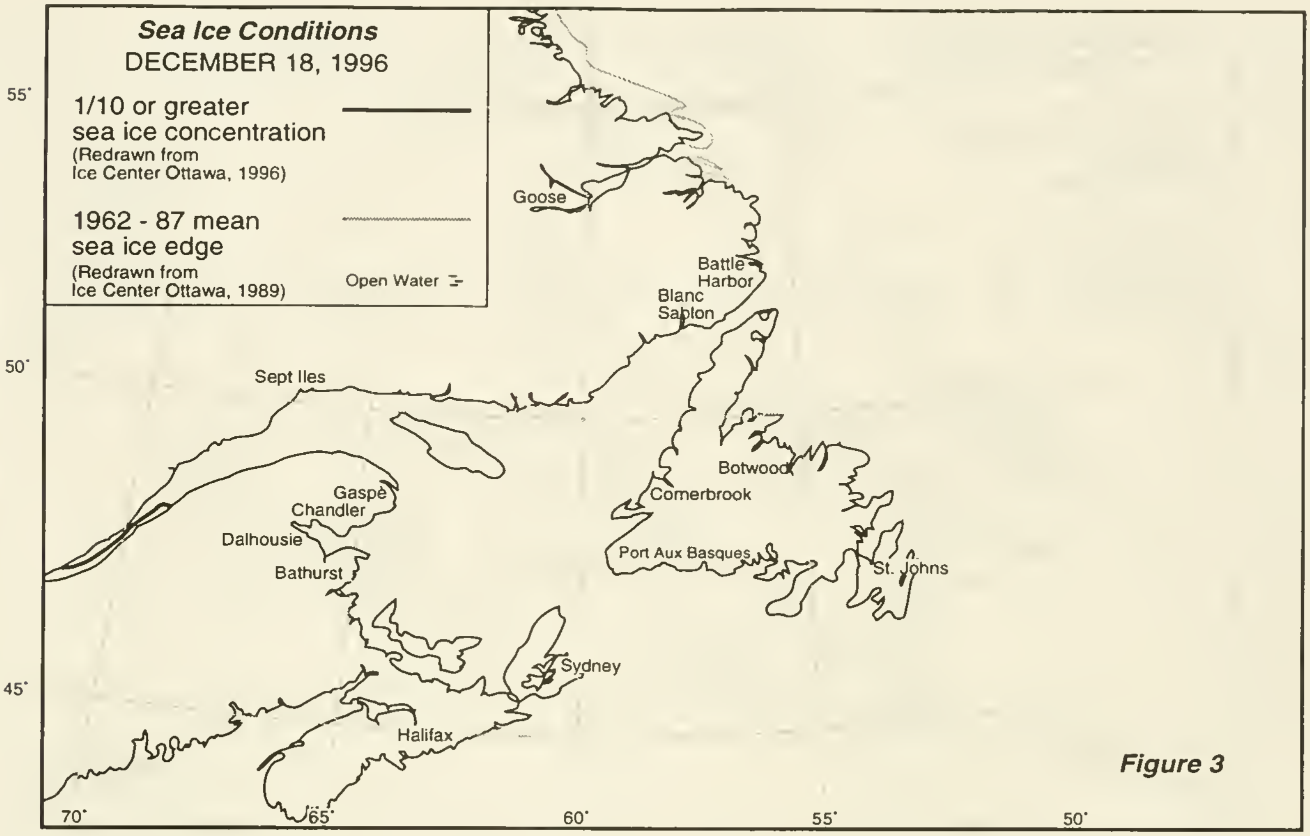


Figure 3

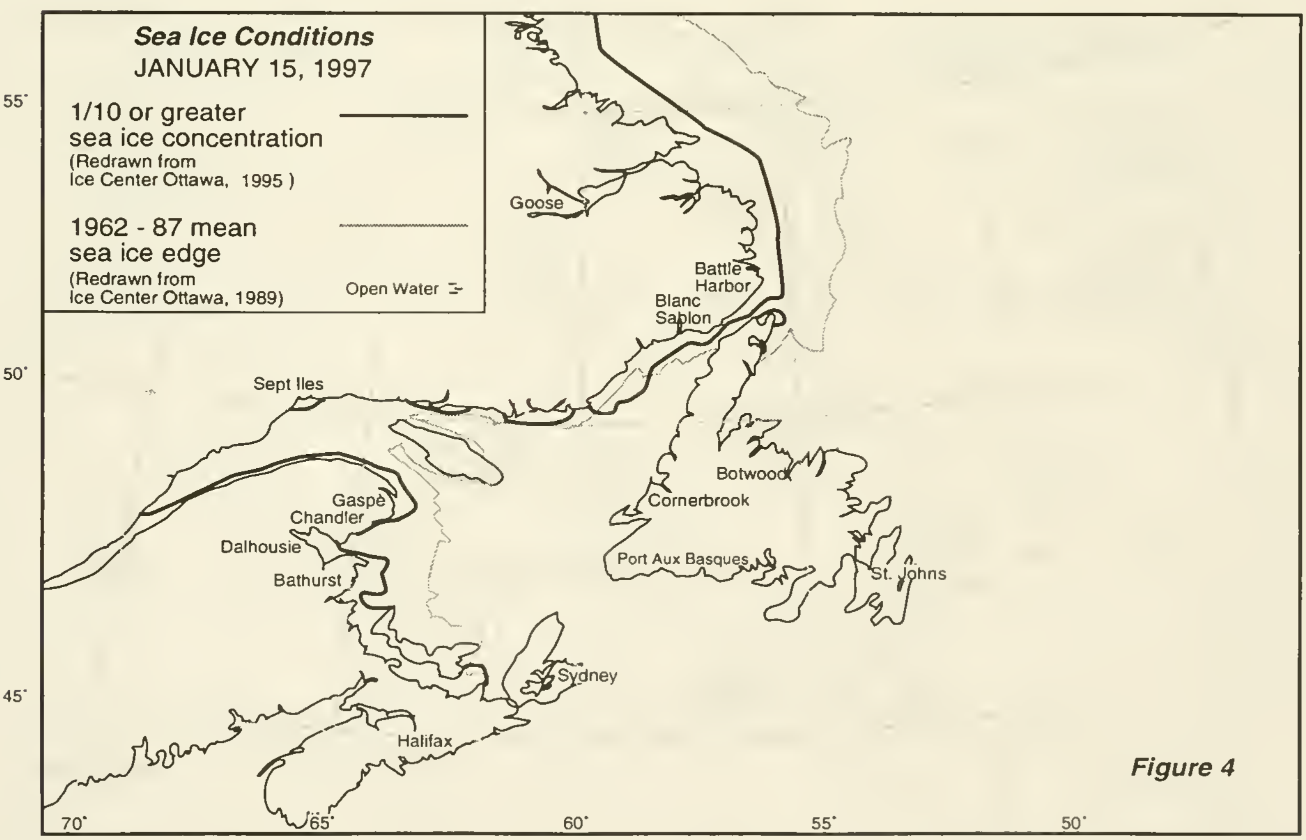


Figure 4

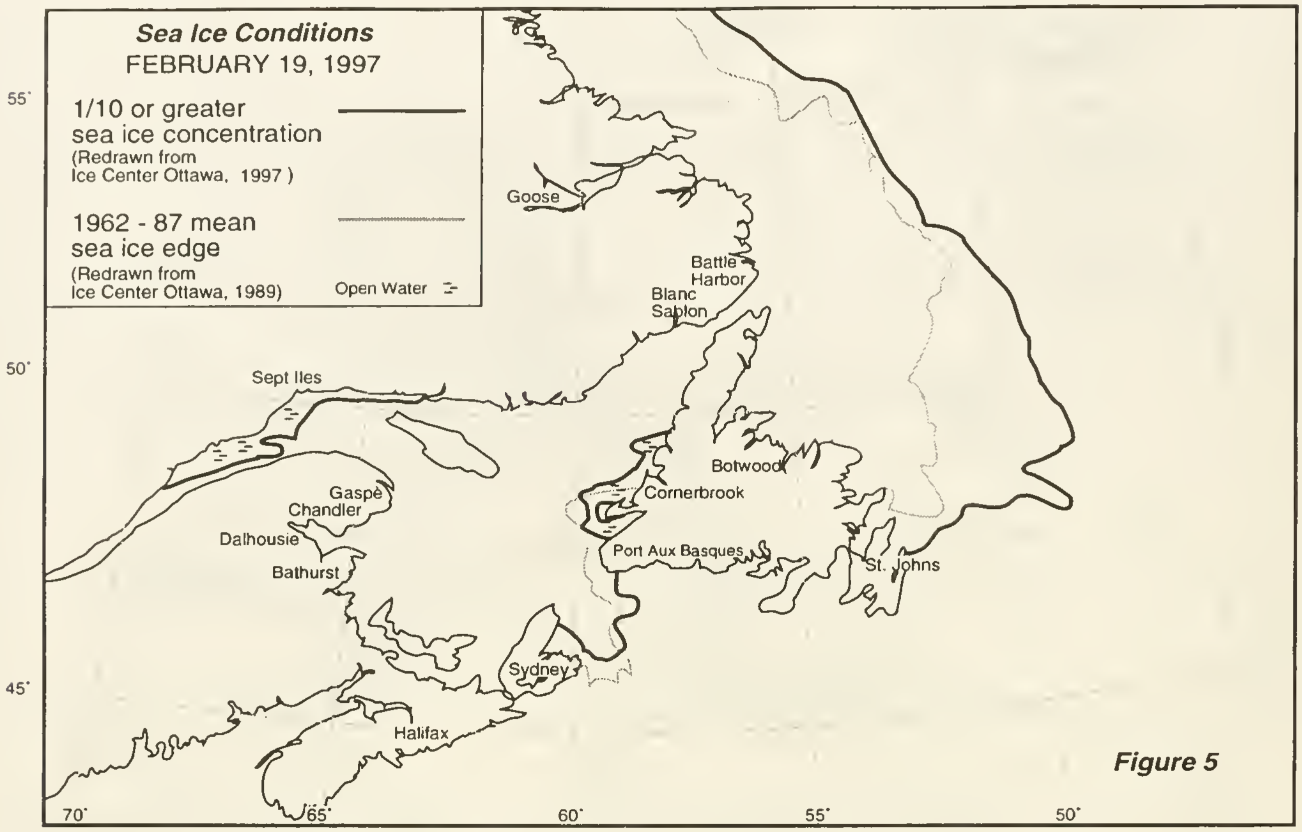


Figure 5

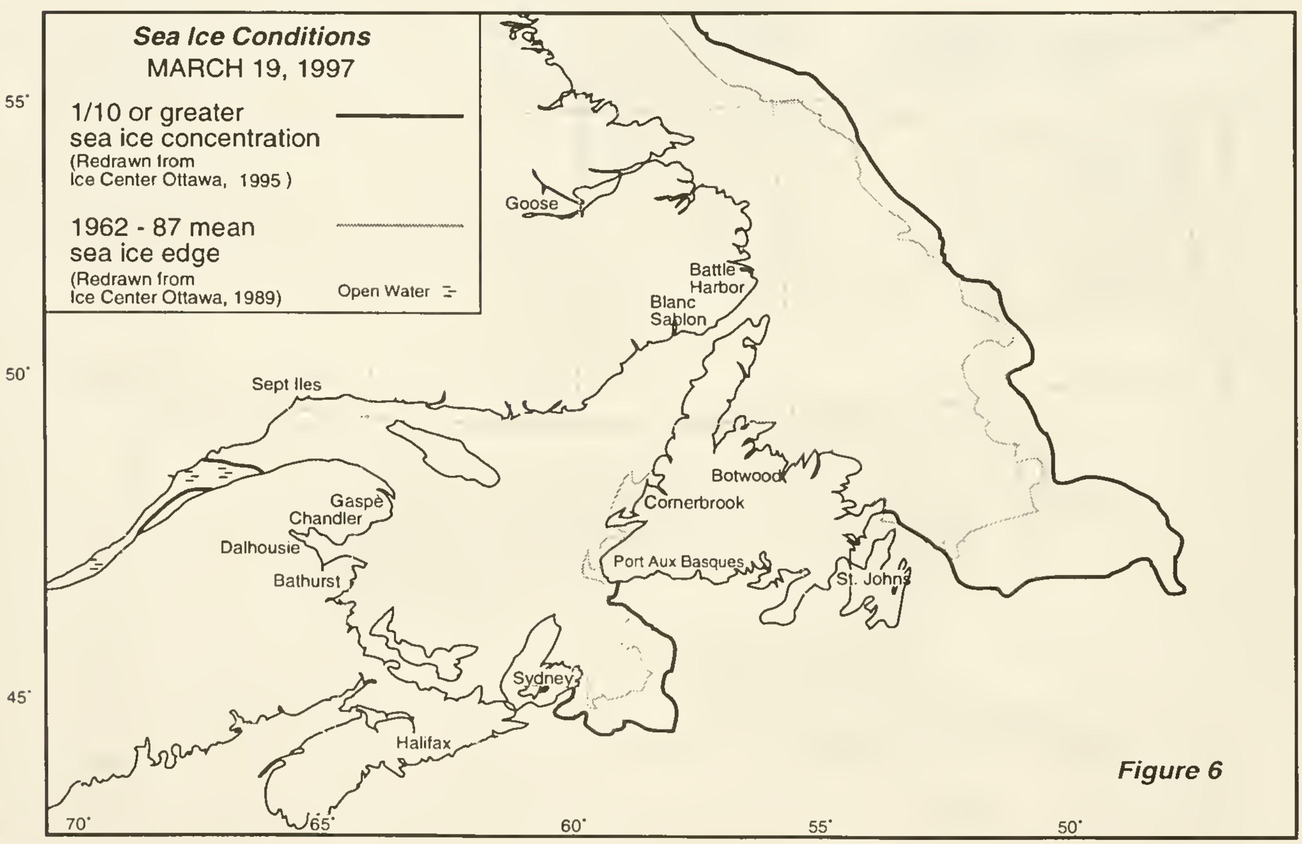


Figure 6

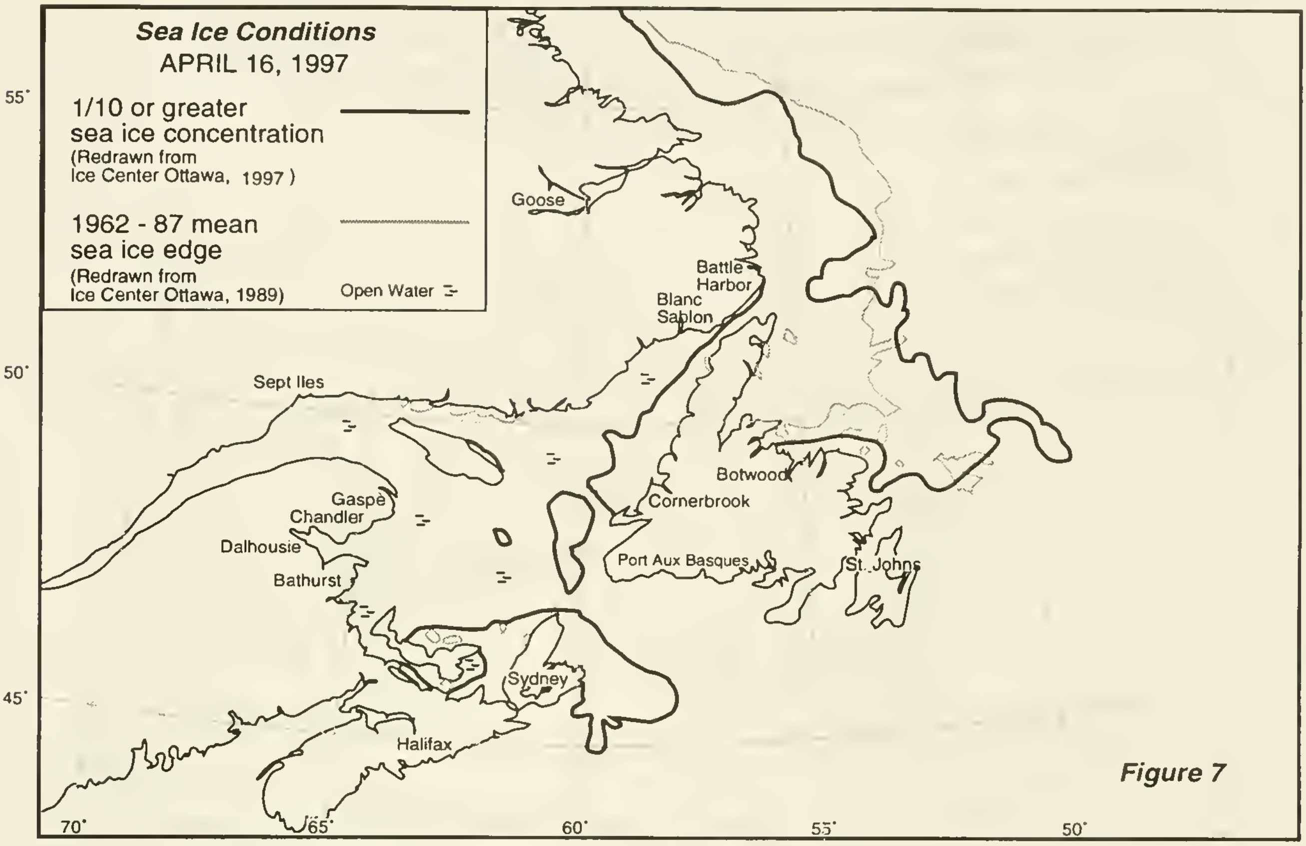


Figure 7

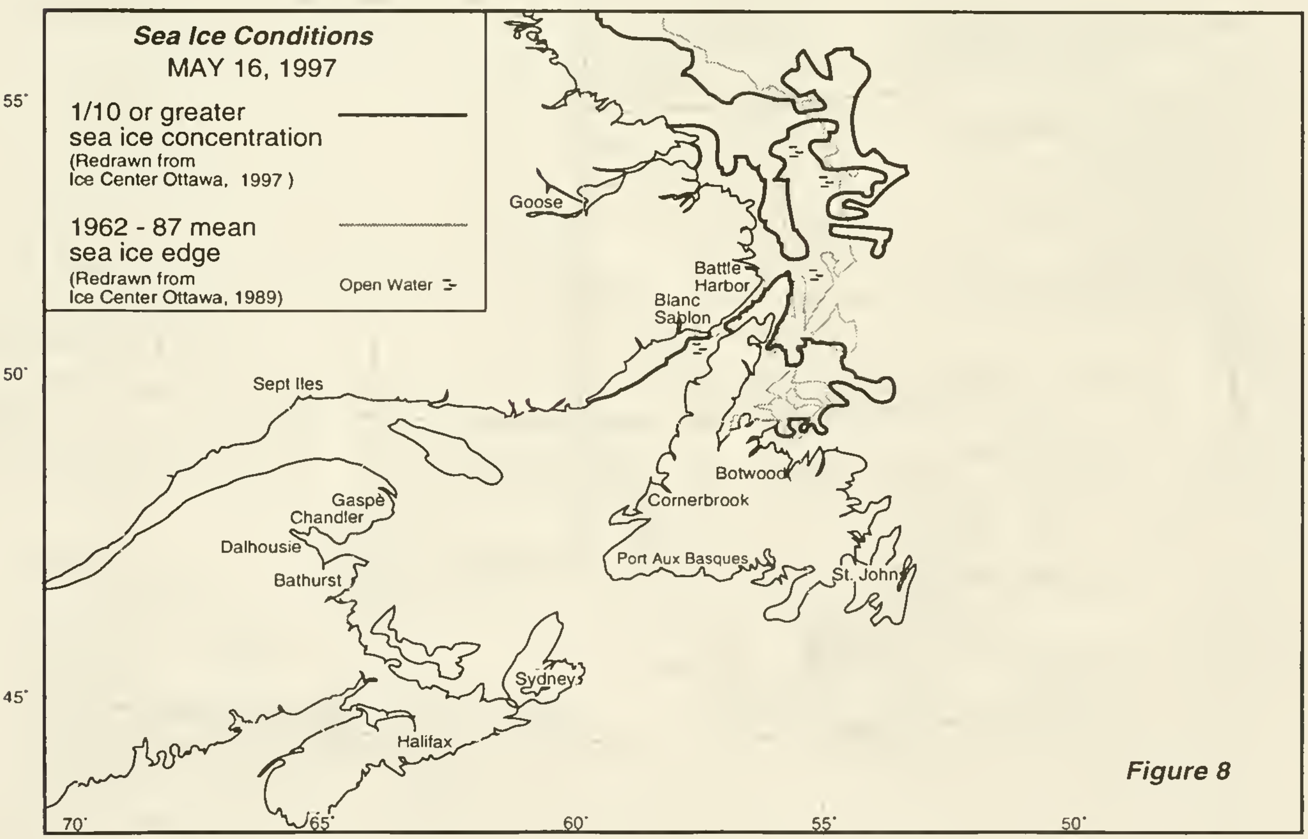


Figure 8

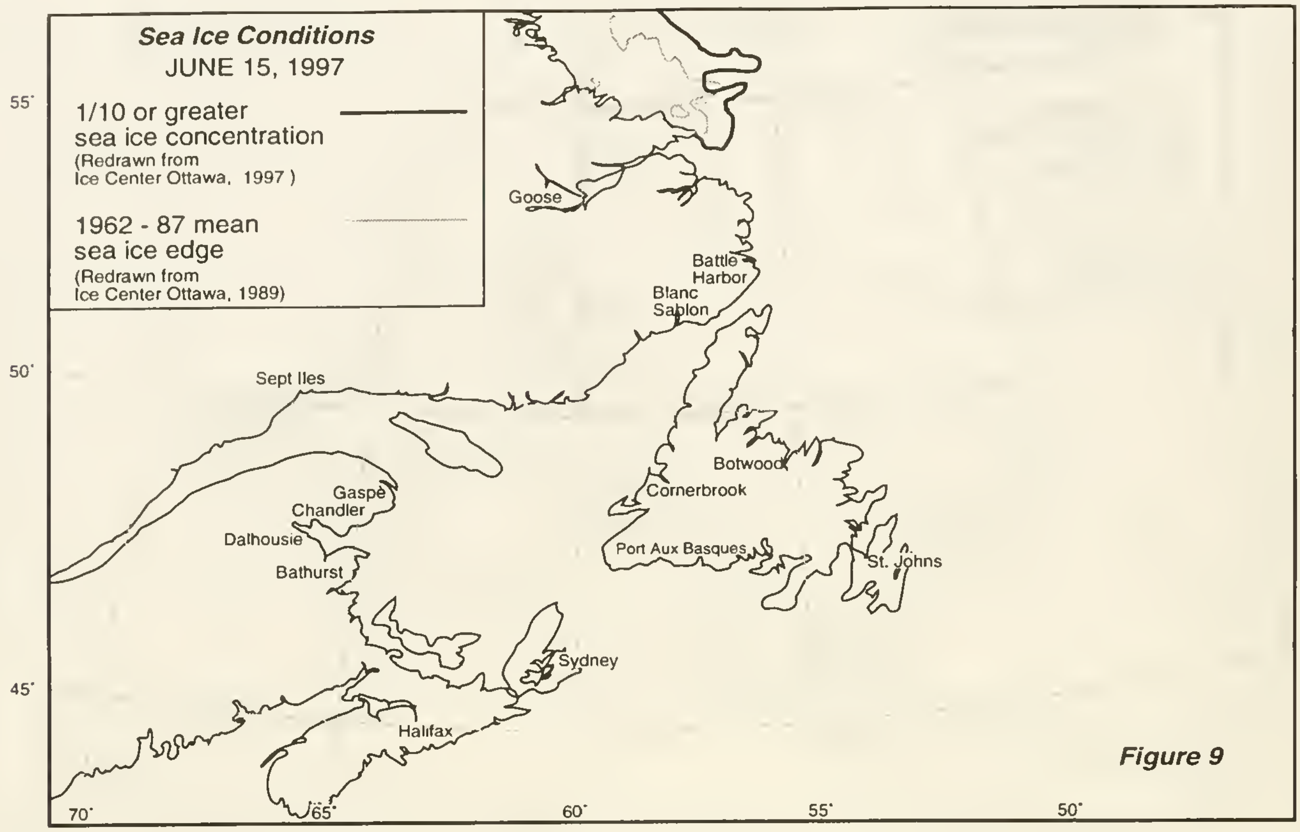


Figure 9

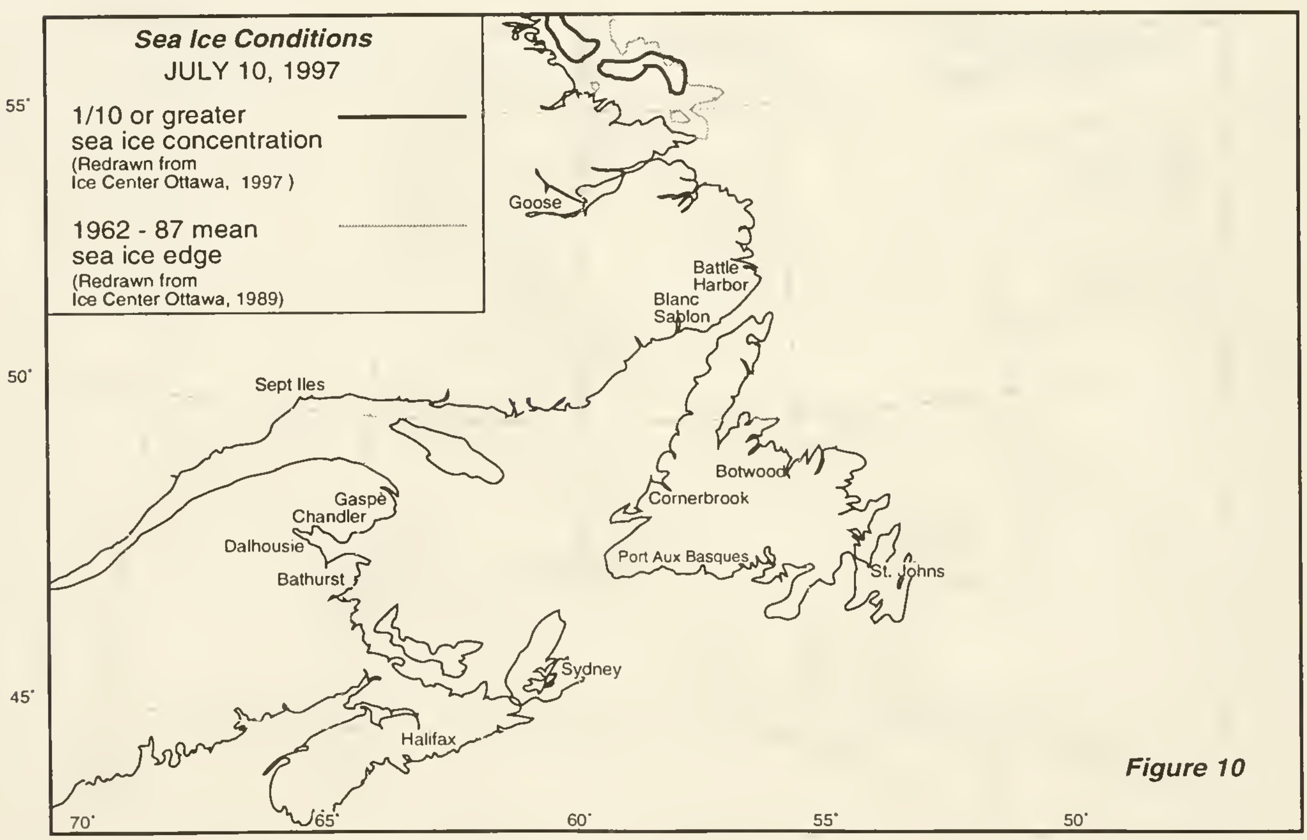


Figure 10

Figure 11
International Ice Patrol Plot for **0000 GMT 15 Mar 97**
Showing Observed and Modeled Iceberg
Positions and Sea Ice Edge

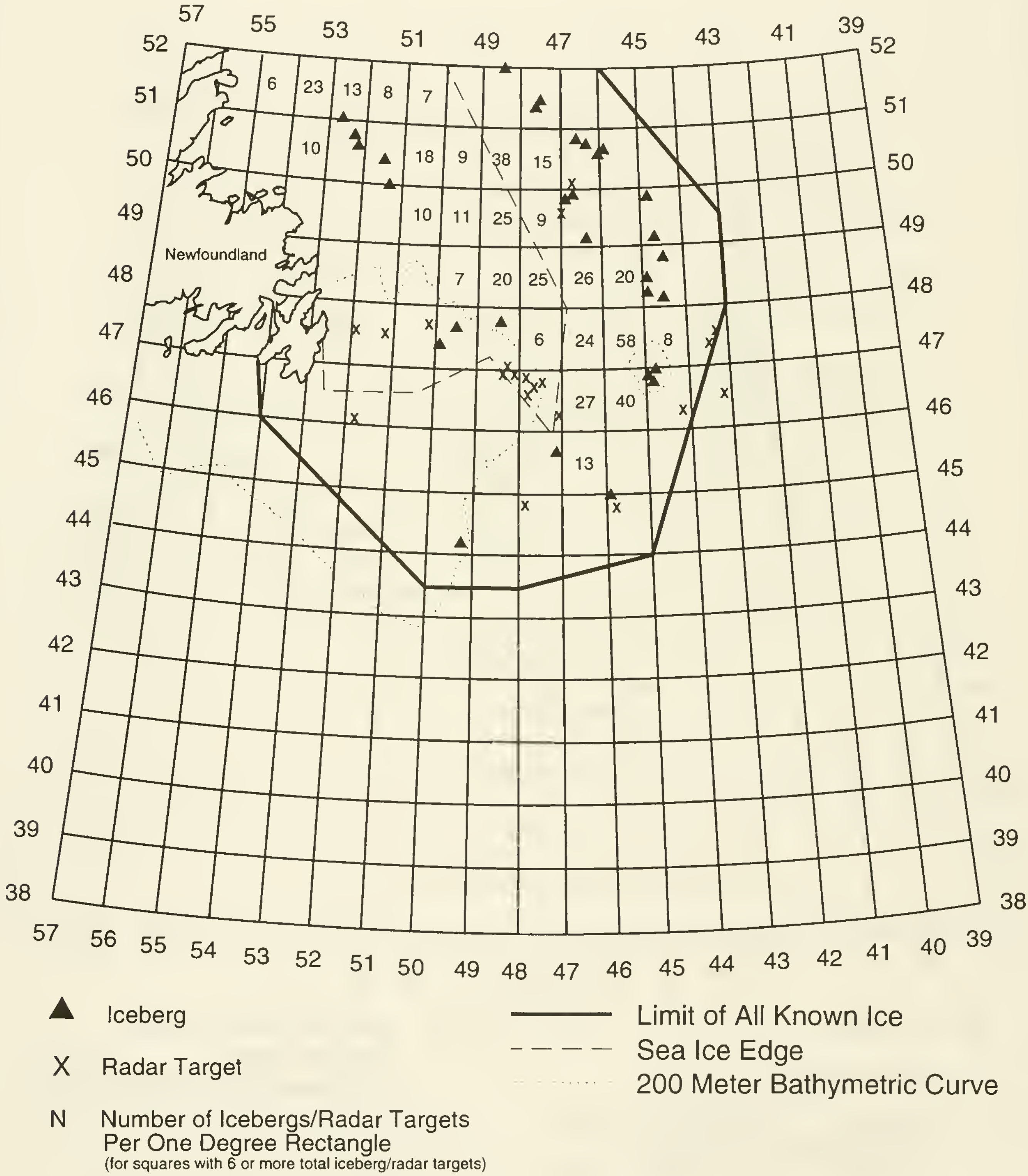
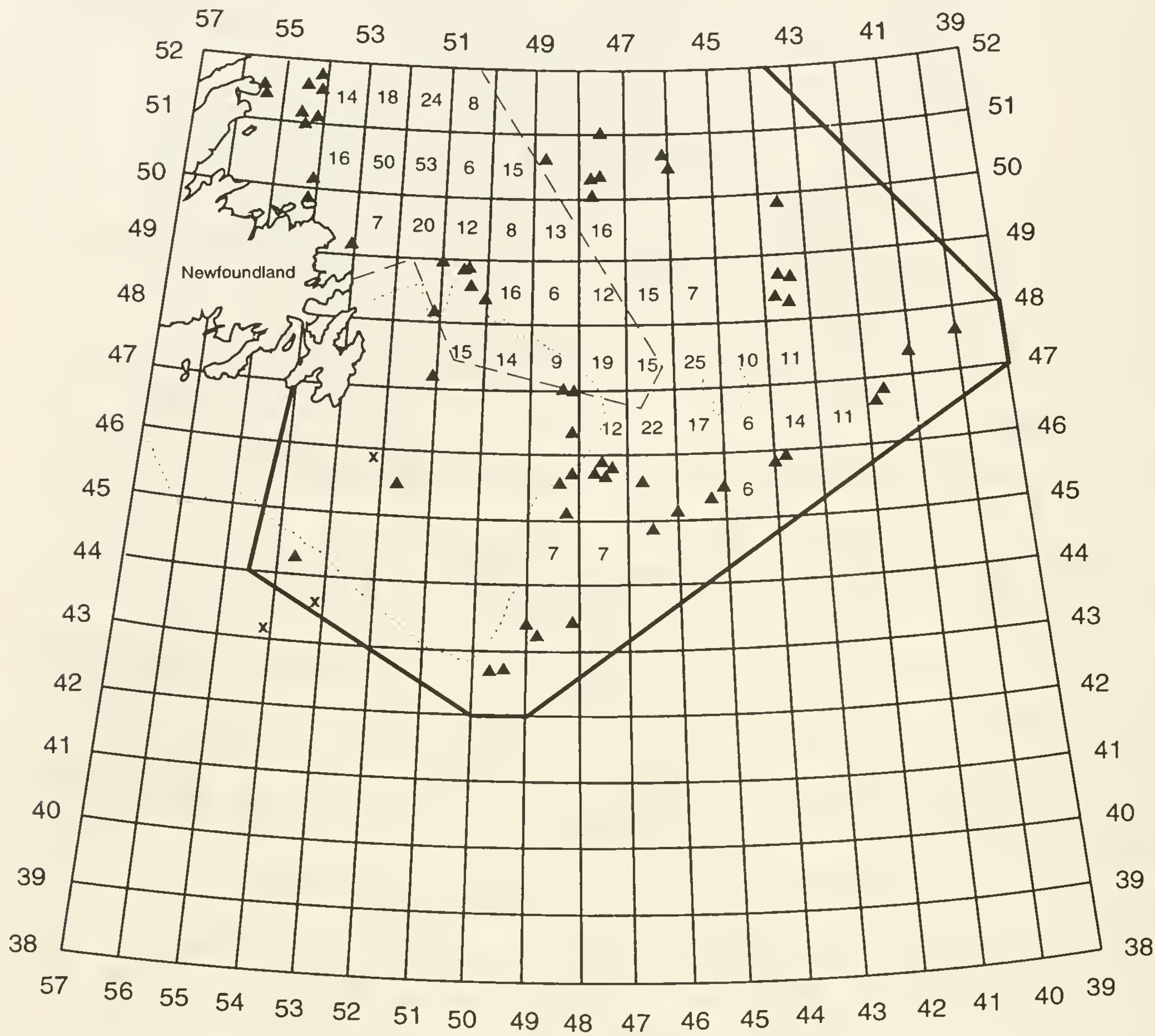


Figure 12
International Ice Patrol Plot for **0000 GMT 31 Mar 97**
Showing Observed and Modeled Iceberg
Positions and Sea Ice Edge



▲ Iceberg

X Radar Target

N Number of Icebergs/Radar Targets
Per One Degree Rectangle
(for squares with 6 or more total iceberg/radar targets)

Limit of All Known Ice

Sea Ice Edge

200 Meter Bathymetric Curve

Figure 13
International Ice Patrol Plot for **0000 GMT 15 Apr 97**
Showing Observed and Modeled Iceberg
Positions and Sea Ice Edge

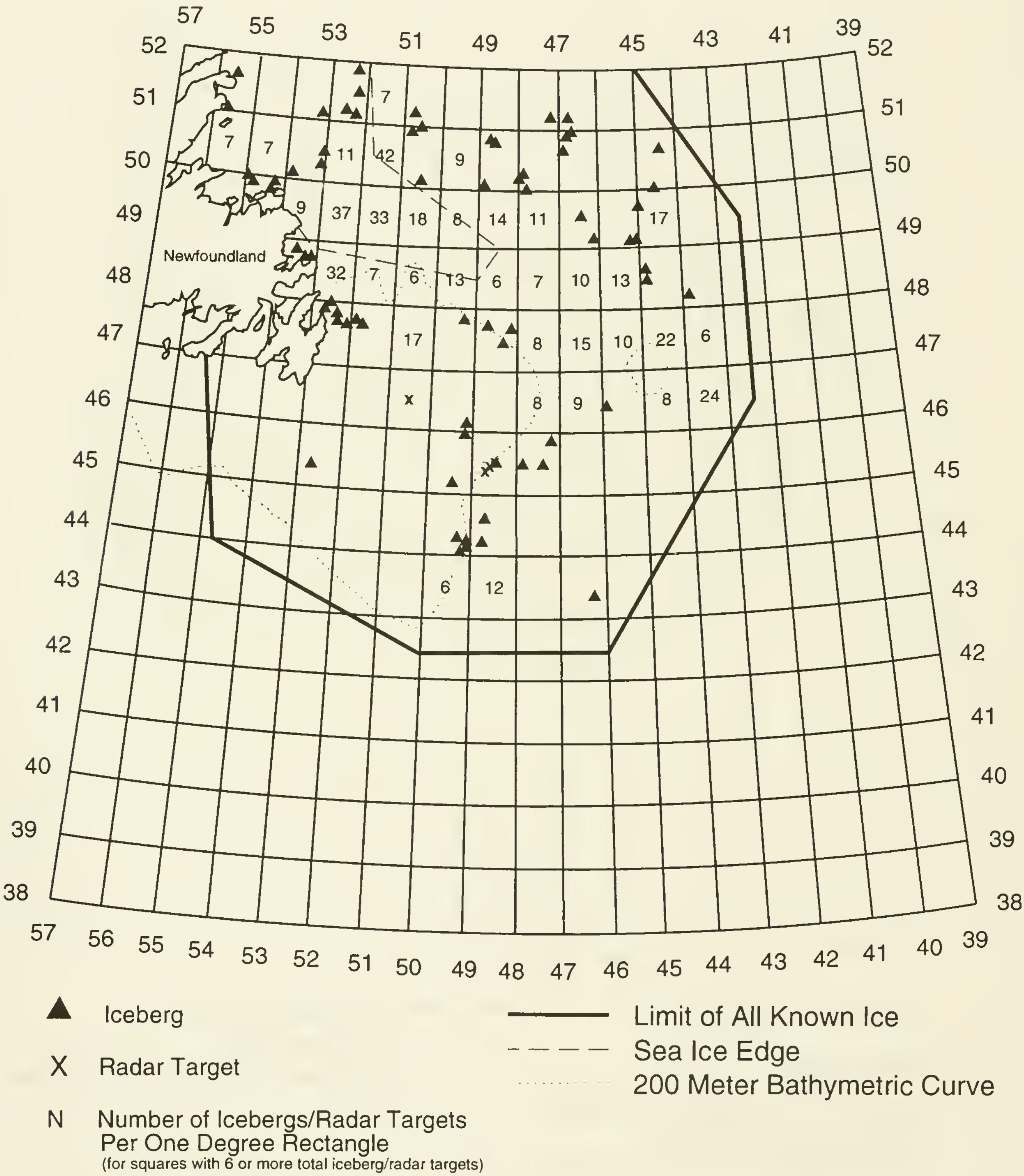


Figure 14
International Ice Patrol Plot for **0000 GMT 30 Apr 97**
Showing Observed and Modeled Iceberg
Positions and Sea Ice Edge

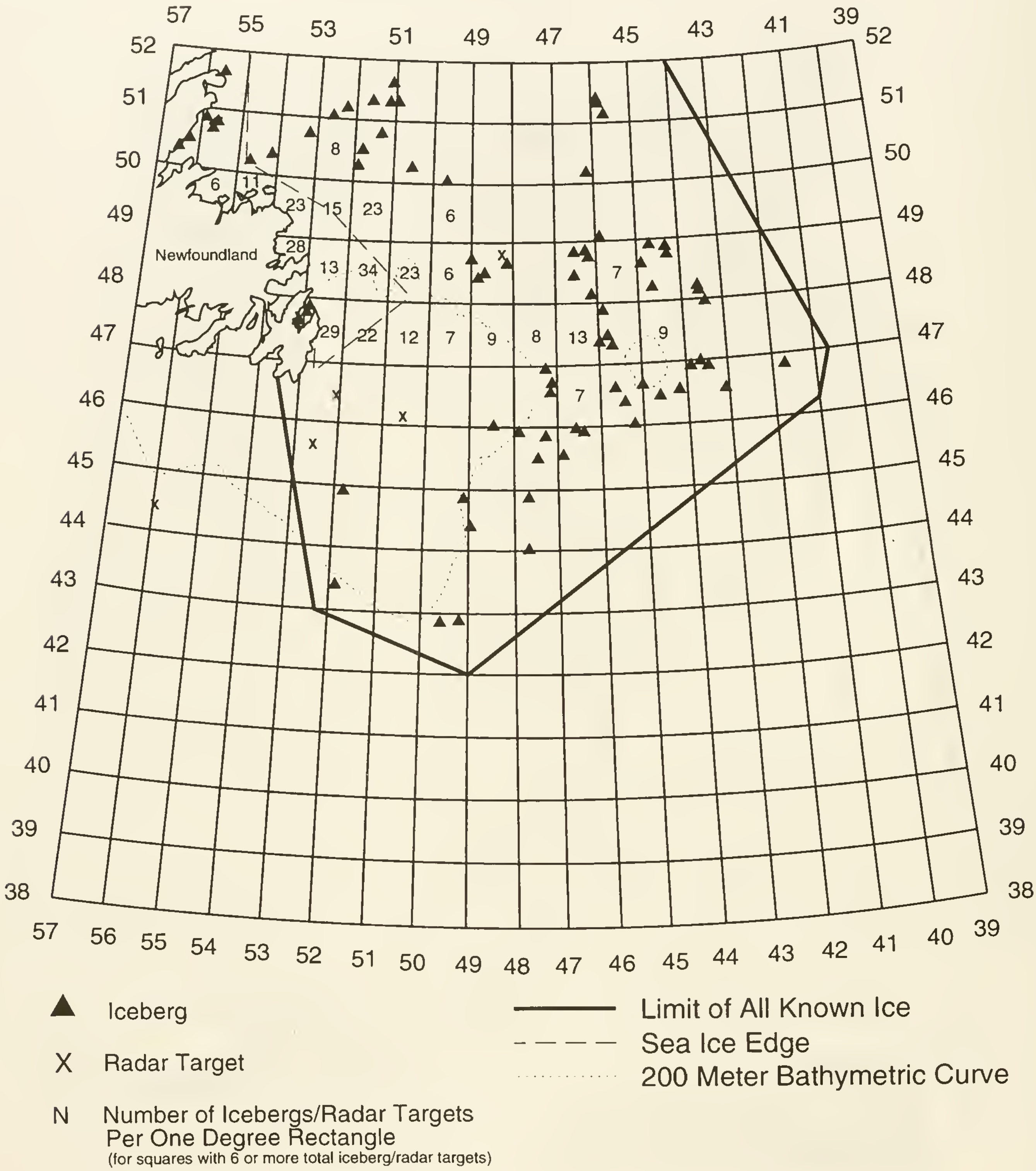


Figure 15
International Ice Patrol Plot for **0000 GMT 15 May 97**
Showing Observed and Modeled Iceberg
Positions and Sea Ice Edge

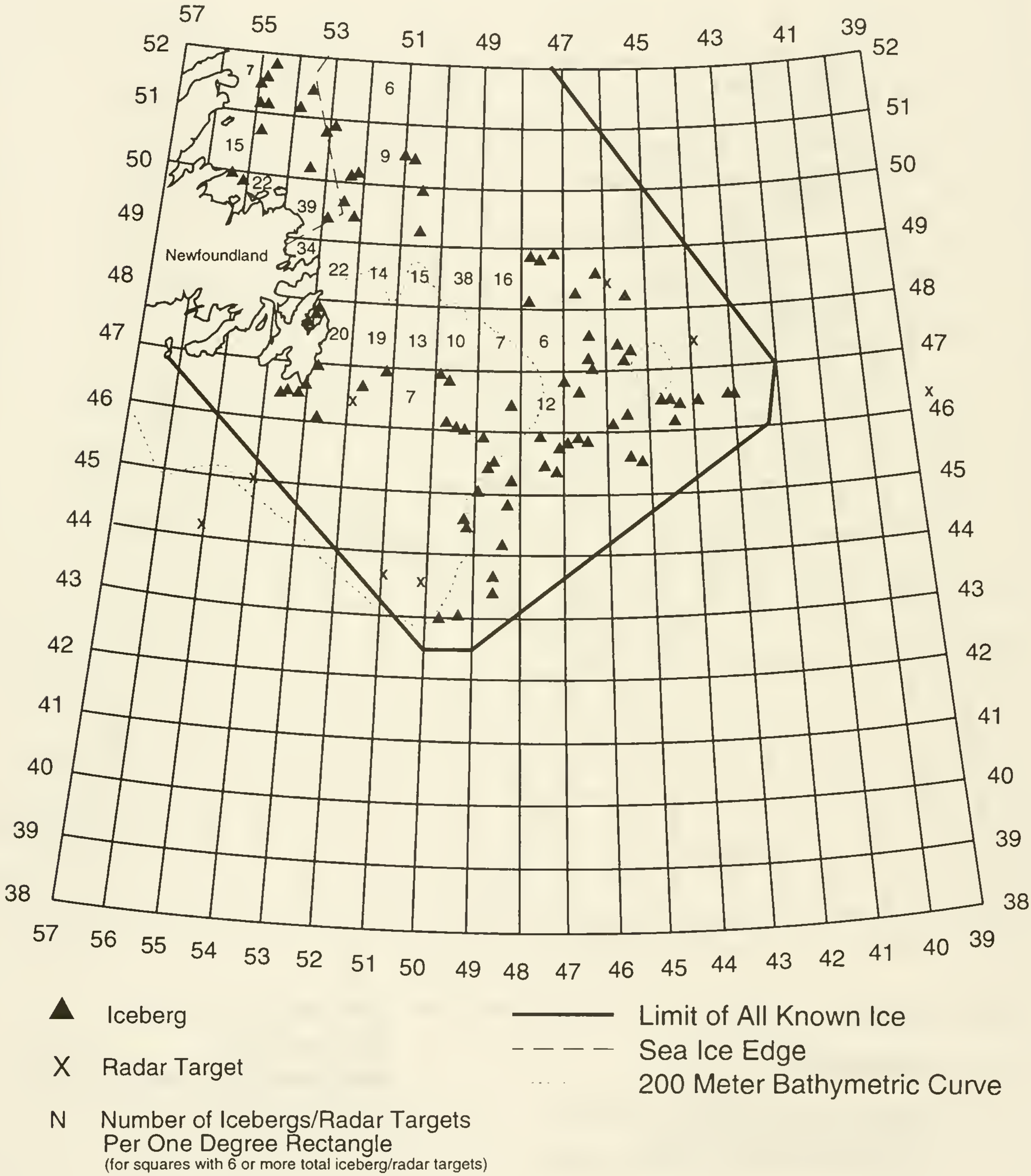
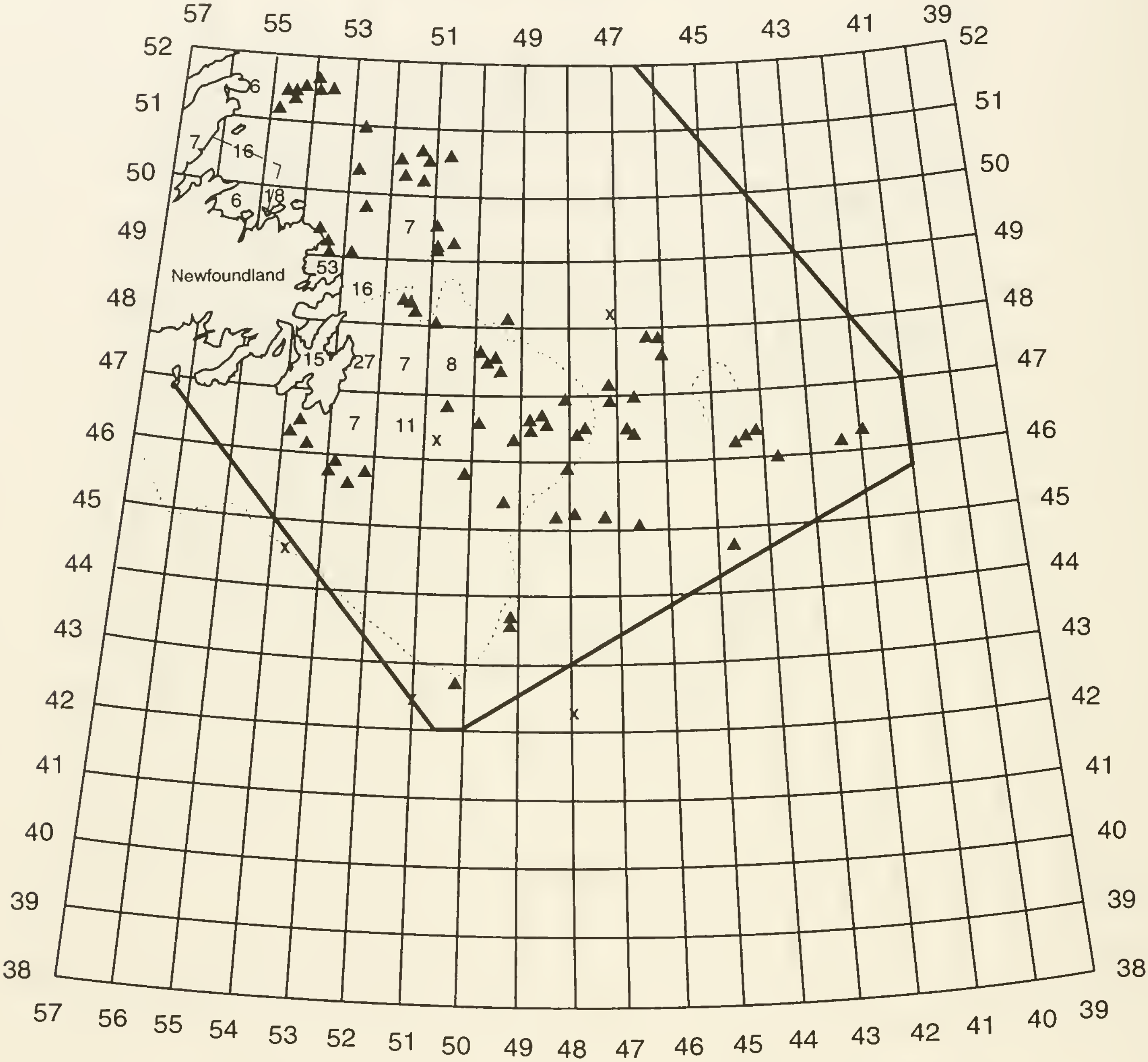


Figure 16
International Ice Patrol Plot for **0000 GMT 31 May 97**
Showing Observed and Modeled Iceberg
Positions and Sea Ice Edge



▲ Iceberg

X Radar Target

N Number of Icebergs/Radar Targets Per One Degree Rectangle (for squares with 6 or more total iceberg/radar targets)

Limit of All Known Ice

Sea Ice Edge

200 Meter Bathymetric Curve

Figure 17
International Ice Patrol Plot for **0000 GMT 15 Jun 97**
Showing Observed and Modeled Iceberg
Positions and Sea Ice Edge

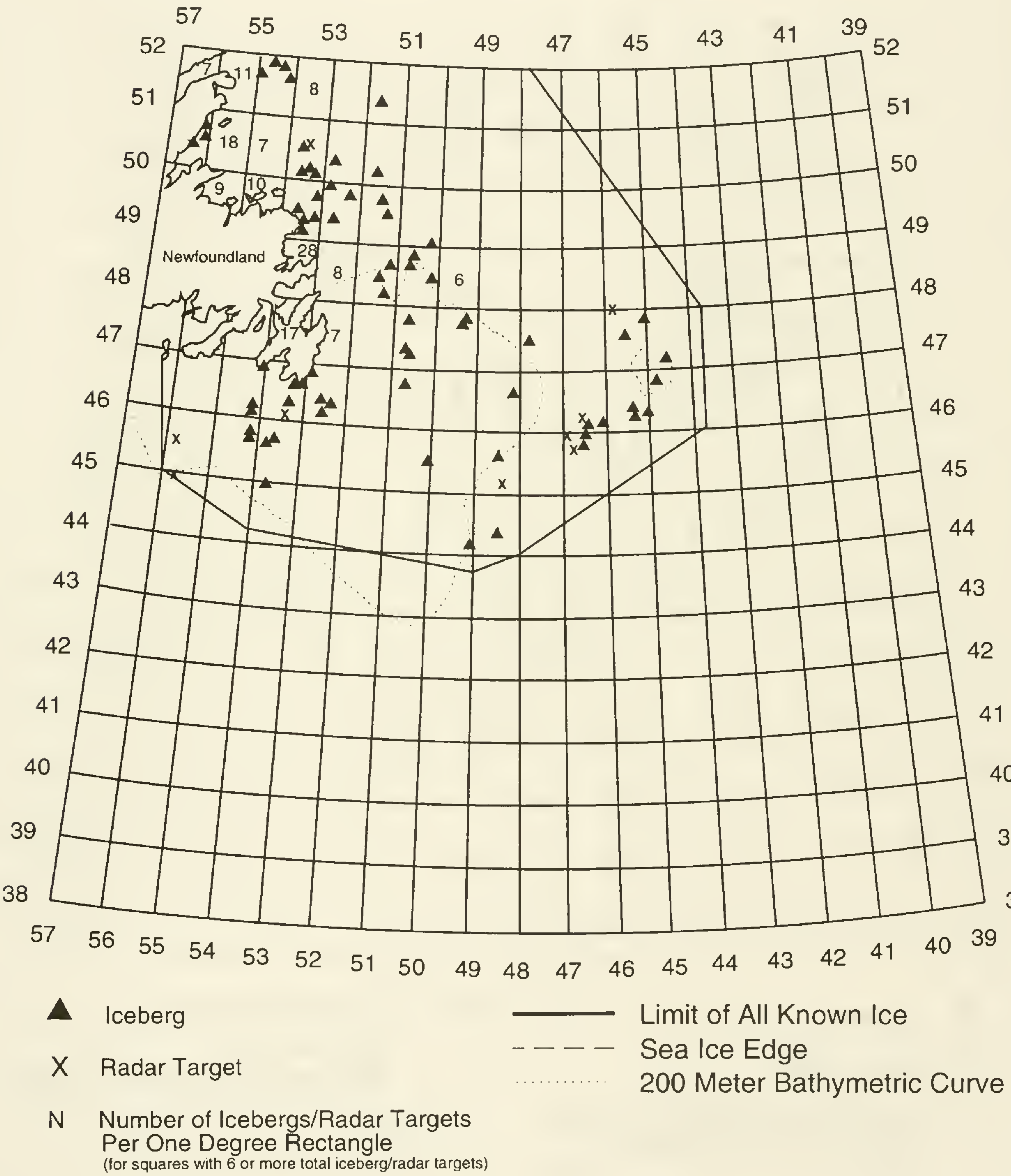
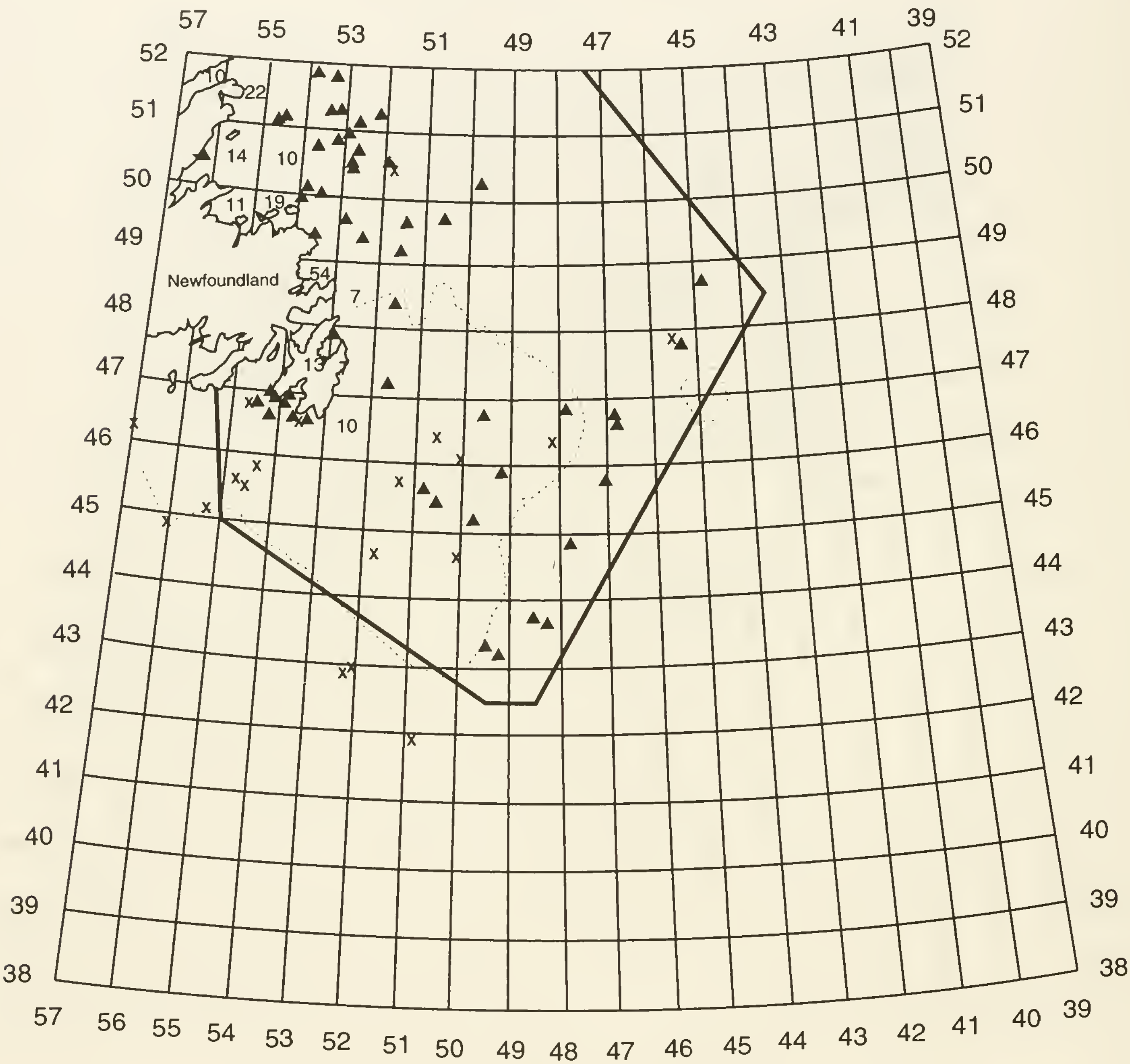


Figure 18
International Ice Patrol Plot for **0000 GMT 30 Jun 97**
Showing Observed and Modeled Iceberg
Positions and Sea Ice Edge



▲ Iceberg

X Radar Target

N Number of Icebergs/Radar Targets Per One Degree Rectangle
(for squares with 6 or more total iceberg/radar targets)

Limit of All Known Ice
Sea Ice Edge
200 Meter Bathymetric Curve

Figure 19
International Ice Patrol Plot for **0000 GMT 15 Jul 97**
Showing Observed and Modeled Iceberg
Positions and Sea Ice Edge

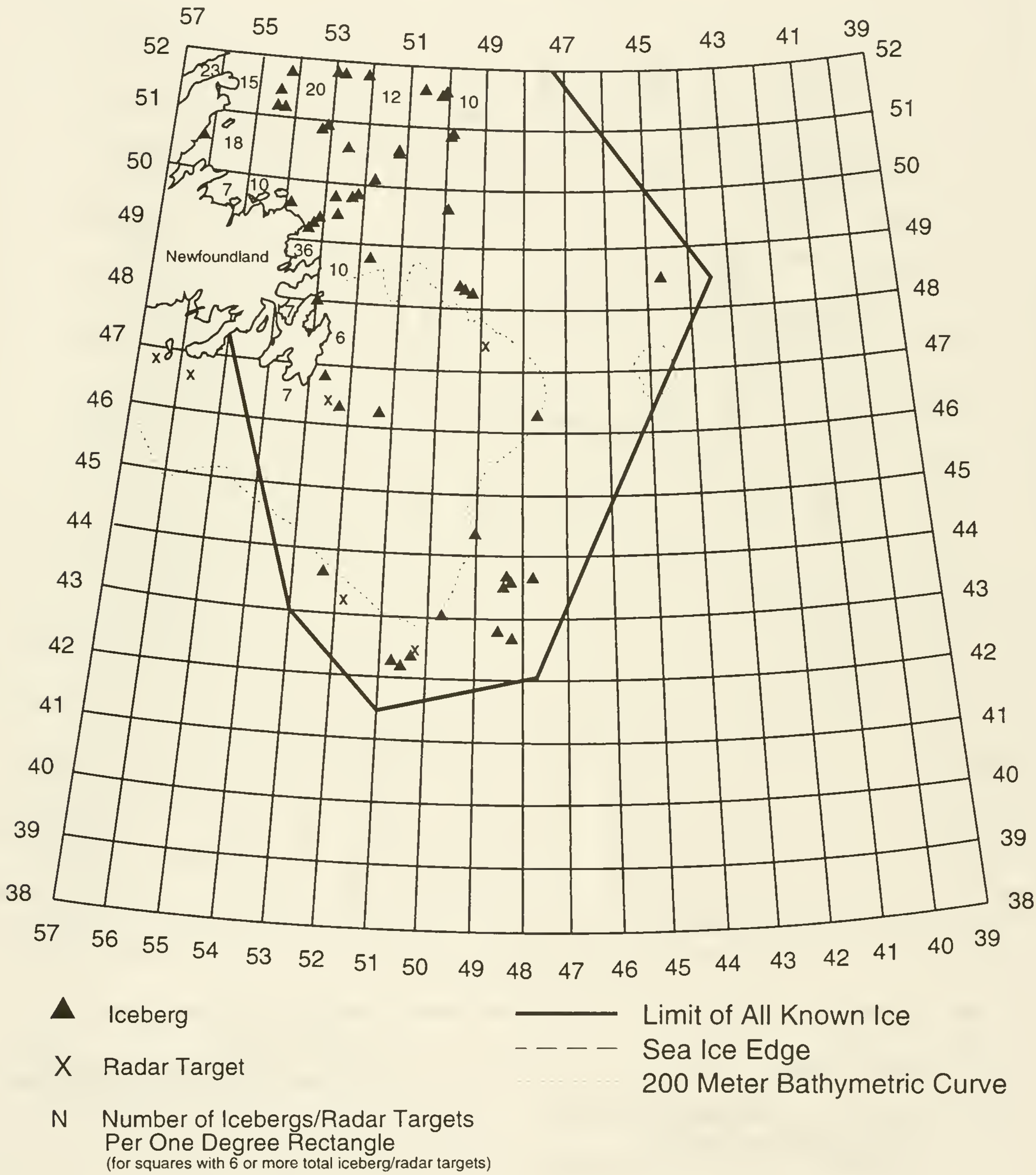
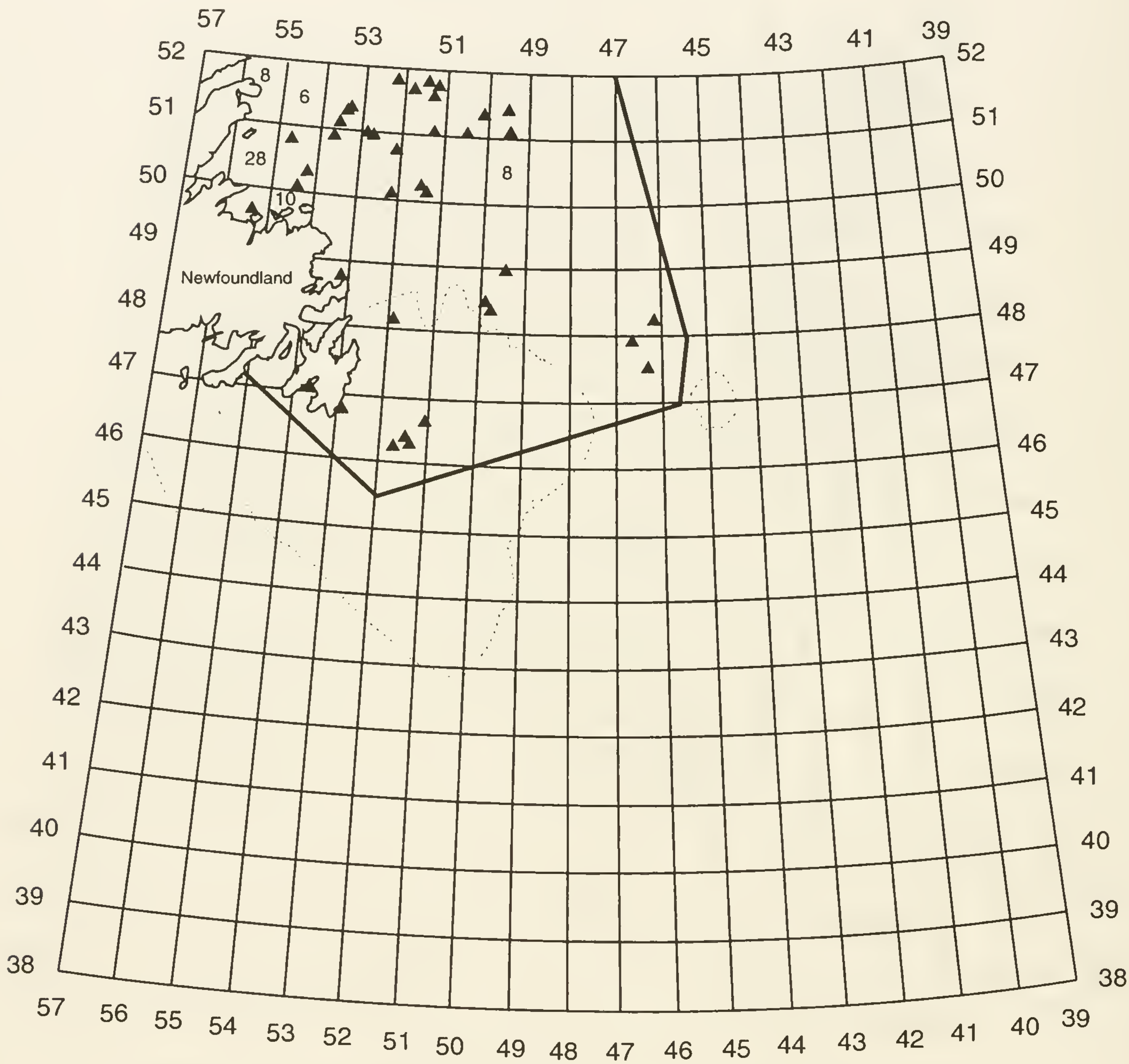


Figure 20

International Ice Patrol Plot for **0000 GMT 31 Jul 97**
Showing Observed and Modeled Iceberg
Positions and Sea Ice Edge



▲ Iceberg

X Radar Target

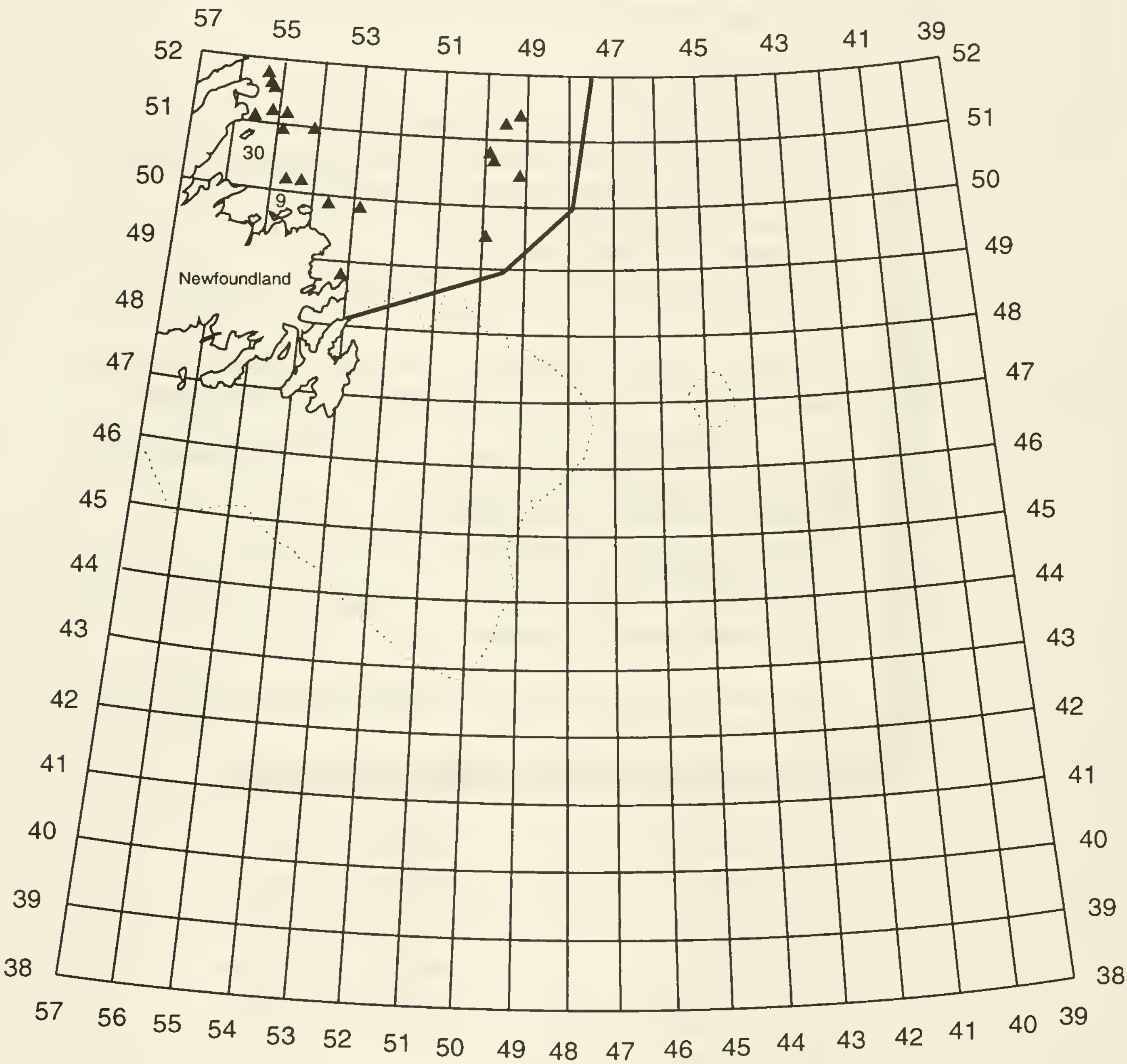
N Number of Icebergs/Radar Targets Per One Degree Rectangle
(for squares with 6 or more total iceberg/radar targets)

Limit of All Known Ice

Sea Ice Edge

200 Meter Bathymetric Curve

Figure 21
International Ice Patrol Plot for **0000 GMT 15 Aug 97**
Showing Observed and Modeled Iceberg
Positions and Sea Ice Edge



▲ Iceberg

X Radar Target

N Number of Icebergs/Radar Targets Per One Degree Rectangle
(for squares with 6 or more total iceberg/radar targets)

Limit of All Known Ice

Sea Ice Edge

200 Meter Bathymetric Curve

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U.S. Coast Guard Atlantic Area Command Center
U.S. Coast Guard Atlantic Area Master Communications Center

We extend our sincere appreciation to the staffs of these organizations for their excellent support during the 1997 International Ice Patrol season:

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CDR R. L. Tuxhorn
CDR S. L. Sielbeck
LCDR M. R. Hicks
Dr. D. L. Murphy
Mr. G. F. Wright
LT R. T. Haines
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MST1 R. A. McKnight
MST1 L. L. Valliere
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MST2 H. R. Harbuck
MST2 J. C. Luzader
MST3 P. J. Jenicek

This report was produced using Adobe Illustrator™ V4 and Adobe™ Pagemaker™ V5 for Windows® by LT Thomas P. Wojahn.

Appendix A
Nations Currently Supporting International Ice Patrol

BELGIUM	NORWAY
CANADA	PANAMA
DENMARK	POLAND
FINLAND	SPAIN
FRANCE	SWEDEN
GREECE	UNITED KINGDOM
ITALY	UNITED STATES
JAPAN	GERMANY
NETHERLANDS	

Appendix B
Ship Reports

Ship Name	Ship Flag	Ice Report	SST* Report
ABITIBI CLAIBORNE	GERMANY	2	
ABITIBI JOHN CABOT	NORWAY	1	
ABITIBI MACADO	LIBERIA	3	
ACADIENNE GALE	CANADA	1	
ADMIRAL PADORIN	RUSSIA	1	
AKMI	GREECE	3	3
AL WAALIYU	PANAMA	1	
ALEXIA	CYPRUS	1	
ALFRED NEEDLER	CANADA	1	
ALIDA GORTHON	SWEDEN	1	
ALLEGRA	PANAMA	1	1
ALOUETTE ARROW	NORWAY	5	
ALPHA	LIBERIA	1	
ALTONA	ANTIGUA/BARBUDA	1	
ANNA DESGAGNES	BARBADOS	1	
APPLEBY	BAHAMAS	4	
ARCTIC SUN	CANADA	1	
ARMELLE	ST VINCENT	5	5
ASTRID	UNITED KINGDOM	1	
ATLANTIC CEDAR	CANADA	1	
ATLANTIC DAUPHIN	CANADA	1	
ATLANTIC ENTERPRISE	CANADA	1	
ATLANTIC ERIE	CANADA	2	
AURIGA	ITALY	15	17
AVALON VOYAGER	CANADA	1	
BACESTI	LIBERIA	1	1
BALSA	NORWAY	2	
BALTIC BULKER	PANAMA	1	
BATALIONY CHLOPSKIE	POLAND	2	2
BELANJA	NORWAY	1	
BERGA FALCON	PANAMA	1	
BERGE NORD	NORWAY	16	12
BERGEN SEA	NORWAY	1	
BERTHEA	NORWAY	1	
BLOEMGRACHT	NETHERLANDS	1	
BLUE BAY	PANAMA	1	
BLUE FLYER	CANADA	1	

* Sea Surface Temperature

Ship Name	Ship Flag	Ice Report	SST* Report
BOW SUN	NORWAY	5	3
BRITISH STEEL	CAYMAN ISLANDS	1	
BULK TAURUS	PHILIPPINES	1	
CAMILLA	FINLAND	1	
CANMAR CONQUEST	UNITED KINGDOM	1	
CANMAR COURAGE	BERMUDA	1	
CANMAR ENDEAVOR	BERMUDA	1	
CANMAR IKALUK	CANADA	1	
CANMAR SPIRIT	HONG KONG	1	
CANMAR SUCCESS	BERMUDA	6	
CANMAR SUPPLIER II	CANADA	1	
CANMAR TRIUMPH	UNITED KINGDOM	1	
CANMAR VICTORY	UNITED KINGDOM	1	
CAPE ROGER	CANADA	5	
CARBUNESTI	LIBERIA	3	3
CAST BEAR	MAURITIUS	6	
CAST LYNX	MAURITIUS	6	
CAST WOLF	SINGAPORE	3	
CHANDA	LIBERIA	9	9
CICERO	CANADA	1	
CONBERRIA	NORWAY	1	
CONCORD	LIBERIA	1	
CONCORDE	ST VINCENT	5	1
CONSENSUS MANITOU	NORWAY	1	
CONTINENT	UNKNOWN	1	
CORNER BROOK	SWEDEN	1	1
CVIJETA ZUZORIC	CROATIA	4	1
CYCLADES	MALTA	1	
DAGEID	BAHAMAS	2	
DARYA MA	HONG KONG	2	
DAVID AGMASHENEBELI	MALTA	2	2
DEVOLAN	LIBERIA	1	
DIAMOND STAR	CANADA	4	
DOBRUSH	UKRAINE	1	
DOCELAKE	LIBERIA	1	
DUESSELDORF EXPRESS	SINGAPORE	1	
DUKE OF TOPSAIL	UNITED KINGDOM	1	
EARL GREY	CANADA	2	
EDAMGRACHT	NETHERLANDS	1	
EEKLO	LUXEMBORG	3	2
EL KEF	TUNISIA	1	

* Sea Surface Temperature

Ship Name	Ship Flag	Ice Report	SST* Report
ELAN VITAL	CYPRUS	8	8
ELIKON	BAHAMAS	3	
ELLISPONTOS	CYPRUS	3	
EMERALD STAR	CANADA	2	1
EMILIE K	DENMARK	1	
EVER ROUND	PANAMA	5	2
FEDERAL AGNO	PHILIPPINES	1	
FEDERAL CALLIOPE	GREECE	1	
FEDERAL MACKENZIE	HONG KONG	1	
FEZZANO	ITALY	5	5
FINCH ARROW	BAHAMAS	1	
FINNFIGHTER	BAHAMAS	1	
FLINTERDAM	NETHERLANDS	1	
FLORENTIA	MALTA	2	
FRIDRIHS CANDERS	LATVIA	2	2
FRONT VIEWER	SINGAPORE	9	9
GADUS ATLANTICA	CANADA	2	
GENERAL CABOL	PHILIPPINES	1	
GENERAL PESCADORES	PANAMA	6	6
GENIE	BAHAMAS	8	4
GERMANIA	GERMANY	2	2
GHOST	CANADA	1	
GODAFOSS	ANTIGUA/BARBUDA	2	
GOLDEN PRINCE	PANAMA	3	
GOOD FRIDAY	BAHAMAS	1	
GORTYS	GREECE	5	5
GREAT LAKER	MYANMAR	8	11
GREEN FROST	BAHAMAS	1	
GREEN ICE	BAHAMAS	1	
GREEN WATERS	CANADA	1	
GUR MASTER	BAHAMAS	1	3
HANSEATIC	BAHAMAS	2	
HANSEWELL	ANTIGUA/BARBUDA	2	
HAVIS	NORWAY	1	
HELLESPONT ORPHEUM	GREECE	1	
HMCS ANTICONTI	CANADA	2	
HMCS ATHABASKAN	CANADA	15	15
HMCS GLACE BAY	CANADA	11	11
HMCS MONTREAL	CANADA	53	53
HMCS PROVIDER	CANADA	10	10
HMCS ST. JOHNS	CANADA	16	16

* Sea Surface Temperature

Ship Name	Ship Flag	Ice Report	SST* Report
HMCS TERRA NOVA	CANADA	17	11
HOFSJOKULL	ICELAND	2	
HOGIFOSSUR	FAEROES ISLANDS	1	
HOPE BAY	PANAMA	1	1
HOSE MARTI	LATVIA	2	
HUMBER ARM	SWEDEN	3	
HUMPHREY GILBERT	CANADA	1	
HYDRA	BAHAMAS	2	3
HYPHESTOS	LIBERIA	1	
IJUIDEN MARU	PANAMA	3	
INDUSTRIAL PATRIOT	USA	1	
INGRID GORTHON	SWEDEN	3	
IRVING ARCTIC	CANADA	6	
IRVING ESKIMO	CANADA	1	
J.E. BERNIER	CANADA	1	
JACQUES DESGAGNES	CANADA	1	
JAMNO	MARSHALL ISLANDS	1	
JEAN CHARCOT	PANAMA	10	10
JERRY NEWBURY	CANADA	1	
JON GORTHON	SWEDEN	8	
KAN	ICELAND	1	
KAPITAN E. EGOROV	RUSSIA	2	
KAPITONAS A. LUCKA	LITHUANIA	7	8
KAPITONAS ANDZEJAUSKAS	LITHUANIA	1	
KAPITONAS MARCINKUS	LITHUANIA	1	
KAPITONAS SEVCENKO	LITHUANIA	5	5
KAPTONAS STULPINAS	LITHUANIA	1	
KAROO	ISLE OF MAN	2	
KENT FOREST	CYPRUS	5	
KENT NAVIGATOR	GREECE	1	
KENT VOYAGEUR	BARBADOS	3	2
KNOCK AN	LIBERIA	12	12
KNORR	USA	3	
KONKAR VICTORY	GREECE	4	4
KOPALNIA RYDULTOWY	POLAND	1	
KYDONIA	CYPRUS	2	1
LA SAULE I	CANADA	1	
LAKE CHAMPLAIN	MARSHALL ISLANDS	1	
LAKE CHARLES	MARSHALL ISLANDS	1	
LAKE ERIE	MARSHALL ISLANDS	5	
LAKE ONIEDA	MARSHALL ISLANDS	2	

* Sea Surface Temperature

Ship Name	Ship Flag	Ice Report	SST* Report
LAKE SUPERIOR	MARSHALL ISLANDS	2	
LARINA	NORWAY	2	
LEONARD J. COWLEY	CANADA	1	
LEONIDAS LAVDA	GREECE	1	
LEOPARDI	MARSHALL ISLANDS	2	1
LI STEVENS III	CANADA	1	
LOCUST	LIBERIA	1	
LOIRE	MALTA	1	
LONDON SENATOR	GERMANY	1	
LUCKY LADY	MALTA	1	
LUCKYMAN	CYPRUS	4	4
MAERSK BISCAY	ISLE OF MAN	1	
MAERSK PACER	DENMARK	1	
MAGDELIN SEA	CANADA	2	
MAJOR HUBAL	POLAND	1	
MALIK 2	VANUATU	1	
MAPLE	BAHAMAS	4	
MARIA GORTHON	SWEDEN	2	
MARIA REBECCA	ITALY	1	
MARKBORG	NETHERLANDS	1	
MATE ZALKA	CYPRUS	1	
MATTHEW	CANADA	2	
MEDALLION	DENMARK	1	
MEKHANIK SLAUTA	RUSSIA	1	
MELUSINE	CANADA	4	
MERIKE	ESTONIA	1	
MINA S.	TURKEY	1	1
MISTY	VANUATU	2	
MLJET	MALTA	6	7
MOKAMI	CANADA	2	
MOR CANADA	CYPRUS	1	
MOR EUROPE	CYPRUS	4	
MOR U.K.	CYPRUS	5	
MORNING DOVE	CANADA	2	
MOUNTAIN BLOSSOM	BAHAMAS	4	5
MURPHY'S LAW	UNKNOWN	1	
NARRAGANSATT	LIBERIA	29	25
NATHELIE SEF	DENMARK	2	
NCC JOUF	NORWAY	1	
NEA DOXA	GREECE	2	2
NIRVANA	CYPRUS	1	

* Sea Surface Temperature

Ship Name	Ship Flag	Ice Report	SST* Report
NISSOS CHRISTIANA	GREECE	12	11
NORD POWER	DENMARK	1	
NORDIC ICE	FAEROES ISLANDS	1	
NORSKALD	BAHAMAS	1	
NORTHERN PRINCESS	CANADA	7	
NORTHERN TUGGER	CANADA	1	
NUKA ARCTICA	DENMARK	1	
OAK	BAHAMAS	2	2
OBRONCY POCETY #249	NETHERLAND ANT	1	
OCEAN BILLOW	CANADA	1	
OCEAN PRAWNS	CANADA	2	
ODIN	GERMANY	6	6
OMISALJ	MALTA	1	
OOCL BRAVERY	HONG KONG	10	
OOCL CANADA	HONG KONG	5	
ORDANES	BAHAMAS	2	2
OSPREY ARROW	BAHAMAS	5	8
PABLO NERUDA	LATVIA	1	
PACIFIC STANDARD	CANADA	2	
PAKARTI RAYA	INDONESIA	3	
PAL MARINOS	CYPRUS	1	
PETROLAB	CANADA	1	
PIERRE RADISSON	CANADA	7	
POITOU	BAHAMAS	4	13
POL AMERICA	PANAMA	1	1
POM KARIN	SWEDEN	1	
POMORZE ZACHONDIE	POLAND	2	
POYARKAVO	MALTA	1	
QUEEN ELIZABETH II	UNITED KINGDOM	1	
RICHARD MATTHIESON	USA	4	4
SAC MALAGA	PANAMA	2	
SAMUEL ELIOT MORISON	USA	40	40
SATURN	CROATIA	1	
SCAN POLARIS	GERMANY	1	
SCOTTY & SISTERS	CANADA	2	
SEA CONCERT	CYPRUS	1	
SEA GYPSY	CANADA	1	
SEA LABRADOR	PANAMA	1	
SEALAND COMET	MARSHALL ISLANDS	1	
SEALAND QUALITY	USA	1	
SEDAT ERKOL	TURKEY	1	

* Sea Surface Temperature

Ship Name	Ship Flag	Ice Report	SST* Report
SIR HENRY LARSON	CANADA	7	
SISHEN	PANAMA	2	2
SOUTHERN DAWN	BAHAMAS	2	2
ST ANTHONY	ISLE OF MAN	1	
STAR OHIO	LIBERIA	27	23
STAR TRONDANGER	NORWAY	1	
STOLT AVENIR	LIBERIA	3	4
STOLT HELLULAND	LIBERIA	1	
STRANGE ATTRACTOR	CYPRUS	5	5
STRONG ICELANDER	USA	1	
STUDLAFOSS	ICELAND	1	
SWAN CLIFF	LIBERIA	2	
SZARE SZEREGI	POLAND	1	
TARONGA	NORWAY	1	1
TELEOST	CANADA	4	
TERRY FOX	CANADA	4	
THORSRIVER	CYPRUS	1	1
TISTEDAL	GERMANY	1	
TITO TAPIAS	CANARY ISLANDS	3	3
TMM MEXICO	MEXICO	1	
TREIMANI	ESTONIA	1	
TRIAS	GREECE	1	
TURID KNUTSEN	NORWAY	1	
TURMOIL	SINGAPORE	2	
UB GEMINI	CAYMAN ISLANDS	1	
UNITED STELLA	LIBERIA	10	17
USCGC EAGLE	USA	3	3
UTVIKEN	BAHAMAS	2	
VALGA	ESTONIA	2	
VERONA	MALTA	2	
VICKY LYNN I	CANADA	1	
VULCAN	MALTA	2	
VULKALLIY	VANUATU	1	
W. JACKSON	CANADA	1	
WADAG	MARSHALL ISLANDS	1	
WALKA MLODYCH	POLAND	3	2
WELLINGTON KENT	CANADA	1	
WESTERN BRIDGE	BAHAMAS	1	
WESTON	SWEDEN	4	1
WILFRED TEMPLEMAN	CANADA	1	
WORLD VALE	LIBERIA	2	

* Sea Surface Temperature

Ship Name	Ship Flag	Ice Report	SST* Report
ZIEMIA GNIEZNIENSKA	POLAND	1	
ZIEMIA ZAMOJSKA	POLAND	3	2

TOTAL ICE REPORTS	864
TOTAL SST REPORTS	483
TOTAL SHIPS REPORTING	285

* Sea Surface Temperature

Appendix C

Limit-Setting Iceberg Report for 1997 Season

CDR Stephen Sielbeck and MST2 L. Scott Howell

Introduction

International Ice Patrol's mission is to identify the Limits of All Known Ice (LAKI) and to transmit this information to mariners at sea. During the ice season, the key element of IIP operations is to conduct reconnaissance patrols to determine the location of icebergs that establish the LAKI.

The LAKI is based on all known iceberg and sea ice information and represents the extent of iceberg danger in the vicinity of the Grand Banks of Newfoundland. From Newfoundland, the line marks the southwestern, southern and southeastern limits of the iceberg region, and ends at an intersection point with latitude 52°N. Over the last twenty years, at its extremes, the LAKI has extended in the northwestern Atlantic Ocean as far south as latitude 39°N and in the east to longitude 37°W.

Limit setting icebergs are those icebergs that form the vertices of the LAKI. International Ice Patrol in recent years has collected data to learn more about these important icebergs. Analysis of this data has indicated the large relative contribution of sightings from IIP reconnaissance flights in this critical area near the limits.

The information pertaining to the limit setting icebergs is important as a measure of effectiveness of IIP's surveillance efforts in locating the iceberg hazard. It is IIP's goal to continuously improve its mission performance by effectively locating the icebergs that constitute the LAKI and accurately provide this information to ships to enable them to avoid encountering icebergs.

Data Collection

Limit setting icebergs were categorized as eastern, southern and western by the side of the LAKI "polygon" where they occurred. For the majority of cases, the three categories of icebergs were distinct populations. The few exceptions were when icebergs drifted from the southern limit to the eastern limit and, in those instances, the iceberg's designation was changed accordingly.

Data on the limit setting icebergs were gathered daily from the output of the Iceberg Data Management and Prediction System (DMPS). Icebergs were recruited as limit setters either from the 1200Z Ice bulletin list of "icebergs not in area of many bergs" or from iceberg sightings by the various source at or near the LAKI. Each day, the icebergs in the limit setter database checked to ascertain any resights or deletions these changes were recorded. The following information was determined for each of the designated limit setting icebergs:

1. DMPS iceberg number
2. Days on plot in DMPS model.
3. Days as a limit setting iceberg.
4. Source of sighting when entered in limit setter database, and any subsequent resighting source.
5. Location on LAKI - (West, South, East)
6. Method of deletion

Collection of data on a given limit setting iceberg ended when it was deleted from DMPS by standard IIP criteria. There are two ways

by which IIP removes an iceberg from DMPS.

1. The iceberg deterioration model predicted the iceberg has melted (Anderson, 1983).

2. The area around the predicted position of the iceberg has been thoroughly searched either through visual or double radar coverage.

Discussion

During the 1997 season, 178 icebergs determined the LAKI. Table 1 lists the sources of the limit setting icebergs when they were initially sighted, or first entered into the iceberg drift model, and when they were last sighted in the area of the LAKI. As in the previous season (Tuxhorn and Krein, 1996), the table shows that IIP reconnaissance was the primary contributor of icebergs that eventually established the LAKI and the major sighting source of the icebergs prior to melting completely and removal from the model.

Table 1
Sources of LAKI Icebergs

Sighting Source	Initial Report (% of Total)	Final Report (% of Total)
Coast Guard (IIP)	41	42
Other Air Recon (GPCD)	21	21
Canadian AES (GCFR)	2	1
Ships	18	22
BAPS	6	4
Other	12	10

Table 2 shows the initial sighting sources for the three categories of icebergs: western, southern and eastern limit setters. Examination of the numbers reveals that IIP provided the largest number of iceberg reports on all three sides of the LAKI. Ships reported limit setting icebergs along the east, south and west regions. Iceberg reports from Canadian AES (GCFR), Other Air Recon (GPCD), and BAPS and Other Sources were concentrated along the eastern limits.

Table 2
Initial Iceberg Sighting Sources With Respect to LAKI Region

Sighting Source	LAKI Icebergs West	South	East	Combined Count
Coast Guard (IIP)	8	45	24	77
Other Air Recon (GPCD)	5	6	24	35
Canadian AES (GCFR)	1	0	3	4
Ships	8	11	10	29
BAPS	0	0	13	13
National Ice Center (NIC)	0	3	13	16
Other	0	0	4	4
				178

The size distribution of the limit setting icebergs, as reported by the final sighting source, is displayed in Table 3. A third of the sightings were reported as 'general sized icebergs", which is the unspecified size used for most

Table 3
Size Distribution of LAKI Icebergs

Size Category	% of Total
Growler	8
Small	12
Medium	25
Large	17
Very Large	5
General	33

part to indicate icebergs detected by IIP radar surveillance.

Again this season, the study showed that IIP's melt model is very important as a tool for maintenance of the LAKI. From Table 4, 69% of the limit setters were deleted after reaching 150% melt. Non-detection of icebergs during reconnaissance patrols accounted for 31% of the deletions, of the icebergs that comprised the LAKI. The reader is directed to the IIP Organization and Procedures Manual (CIIPINST M5400.1) for the policies pertaining to deletion of icebergs from the model.

Table 4
Deletion Method of LAKI Icebergs

Method	% of Total
150% Melt	69
200% Radar Coverage	23
Visual Recon Coverage	8

The results from this work have yielded a better understanding of the contributing surveillance sources and the final fates of the limit setting icebergs. In the 1997 Season, 4839 icebergs (including resights) were entered in the IIP iceberg drift models, of which 178 were used to set the LAKI. For comparison, in the 1996 Season, 3902 icebergs were entered in the IIP iceberg drift model, of which 110 became limit setters. Assuming data from these two years are typical, the great majority of icebergs which pass south of 52°N latitude or are detected in the IIP operations area melt before they ever approach near the LAKI.

This season's study reinforced a finding of the 1996 study, that approximately half of the limit setting icebergs are detected by IIP reconnaissance. In 1996, 61% of the limit setting icebergs were initially detected by IIP patrol flights conducting reconnaissance patrols near the limits. For the 1997 season, IIP patrols accounted for 41% (Table 1) of the initial sightings of limit setting icebergs. Most of these detections occurred near the LAKI, which means these icebergs either make it through the IIP operations area (from 52°N to LAKI) undetected or are created in the region near the LAKI. If the latter is considered, it suggests that the splitting of icebergs into "pieces" as they journey south, and especially in the vicinity of the LAKI, is an important process of their deterioration. Regardless of how they get there, the fact that these icebergs are found a the LAKI gives impetus for IIP to remain vigilant in this region.

References

Anderson, I., 1983, “Iceberg Deterioration Model”, Report of the International Ice Patrol in the North Atlantic, 1983 Season (CG-188-38), pp. 67-73.

Tuxhorn, R. L. And T. T. Krein, 1996, “analysis of Limit Setting Icebergs”, report of the International Ice patrol in the North Atlantic, 1996 Season (CG-188-51), pp. 39-42.

Appendix D

Analysis of IIP Reconnaissance Results

CDR Stephen L Sielbeck and MST2 Tristan T. Krein

Introduction

International Ice Patrol provides a seasonal service of iceberg patrols when the presence of icebergs threatens the North Atlantic shipping routes near the Grand Banks of Newfoundland. Information concerning iceberg conditions near the limits of all known ice is collected primarily through air surveillance conducted by IIP.

IIP reconnaissance data, iceberg reports from other sources, ocean currents and relevant environmental data are used by iceberg drift and deterioration computer models. Every twelve hours, the numerical models estimate iceberg positions and determine the limit of all known ice (LAKI). This limit is broadcast as ice bulletins and facsimile charts to ships crossing the Atlantic Ocean between Europe and North America. Data collected from each of the 1997 ice season patrol flights, when used with similar data from the 1995 and 1996 seasons (Table 1), provide a useful gauge of the effectiveness of IIP reconnaissance efforts and the accuracy of drift and deterioration models.

Data Collection

Data on iceberg detections, iceberg deletions, and changes to the LAKI from iceberg patrols in 1997 are shown in Table 2. The iceberg detection numbers (icebergs, growlers, and radar targets) were taken from the flight messages reporting results of each iceberg reconnaissance flight. There were fifty five (55) patrol flights in 1997. The number of icebergs deleted as a result of each patrol was derived from the process of merging the patrol information into the iceberg computer database. Iceberg deletions from the database involve duty watch officer decision making within parameters set down in "Standing Orders For IIP Operations Center Duty Personnel" (CIIP Instruction M3120B). Changes to LAKI, calculated in square nautical miles, were determined by simple comparison of the limits before and after reconnaissance information were merged into the model.

Discussion

The iceberg population in the vicinity of the Grand Banks varies annually with respect to numbers, density and distribution. The limits of all known ice are normally defined by a small number of icebergs. The average number of iceberg detections per patrol in 1997 was 14 and the average number of deletions was 8 icebergs. The variation in iceberg sightings from one patrol to the next is a function of the geographic location of the patrol area; patrols near LAKI usually yield small counts while patrols farther north result in higher numbers of detections. Deletions occur when an area is surveyed with acceptable visibility or radar coverage and the patrol does not find any ice near predicted iceberg positions.

The change of ocean area enclosed by LAKI resulting from reconnaissance patrols in 1997 is depicted in Figure 1. Increases in area indicate iceberg detections close to or outside LAKI, conversely, decreases result from an absence of icebergs at predicted locations. Of 55 patrols, 22 reduced and 5 increased the area defined by LAKI. The re-

maining 18 flights neither increased nor decreased the area enclosed by LAKI. This does not imply that the limits were accurate on those dates because several of those patrols were special purpose flights to deploy drifting buoys or to verify iceberg density at interior locations. A few patrols were incomplete, due to sensor or aircraft problems, and had no inpact on the limits. On two occasions IIP reconnaissance detected ice outside LAKI. The most dynamic regions, and the area most important to shipping, were the southern limits of all known ice. Typically, the southern limits had the highest priority for each ice reconnaissance detachment's patrol efforts.

IIP strives to maintain accurate LAKI, neither underestimating nor overestimating the threat icebergs pose to mariners. Effective reconnaissance and proficient model performance are expected to produce only nominal changes in LAKI. The 1997 reconnaissance data suggest that the drift and deterioration models are conservative, since, in most cases, the flights reduced the area enclosed by LAKI. On the other hand, there were six occasions in 1997 when ice was observed outside IIP's published LAKI. While this is a small error (~2%) when compared to the 330 ice bulletins produced by IIP in 1997, it is significant because mariners were unaware of these dangerous icebergs. As a result, we do not wish to make our models less conservative. The data emphasize the importance of regular, effective reconnaissance in maintaining accurate LAKI.

Table 1
1995 - 1997 Reconnaissance Patrol Data

	YEARLY AVERAGES			
Ice Season	**1995**	**1996**	**1997**	**95'-97' Average**
Icebergs South of 48N	1432	611	*1011*	1018
Patrol Flights	45	46	*55*	49
Patrol Results (per flight):				
Icebergs Detected	38	16	*14*	23
Growlers Detected	13	2	*1*	5
Radar Targets	3	1	*2*	2
Total Targets Detected	54	19	*17*	30
Targets Deleted	45	11	*8*	21
Change in LAKI (SQNM)	-1031	-4648	*-5424*	-3701

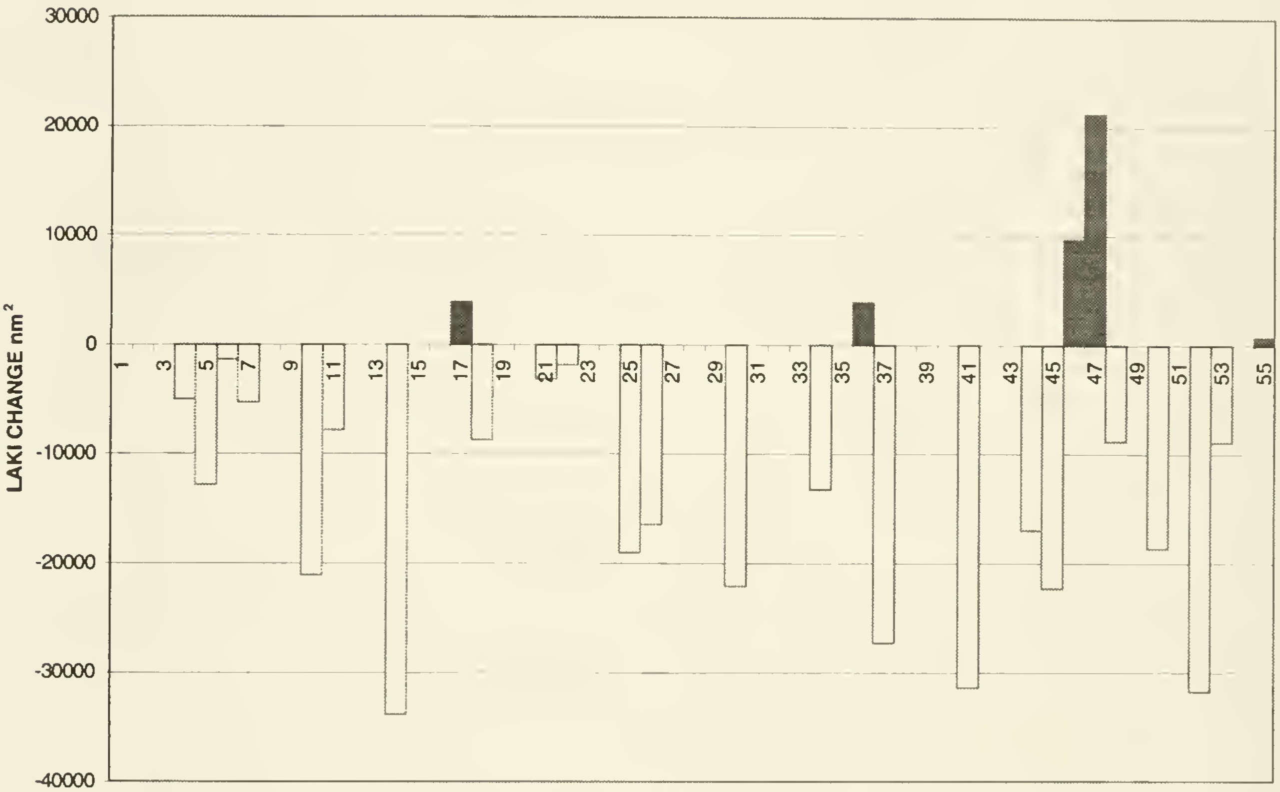
Table 2

1997 IIP SEASON

FLT	DATE	IRD	Icebergs	Growlers	Radar	Sights	Deletes	LAKI nm^2	REMARKS
1	31-Jan	0	0	0	0	0	0	0	S LAKI / Pre-Season Log
2	26-Feb	1	0	0	0	0	0	0	S LAKI
3	2-Mar	1	59	0	2	61	0	0	E LAKI / WOCE / Foul Wx
4	4-Mar	1	12	1	2	15	4	-5,000	E LAKI / WOCE/Season Start
5	13-Mar	2	1	0	0	1	4	-12,800	S LAKI
6	14-Mar	2	48	3	0	51	0	-1,400	SE LAKI
7	15-Mar	2	55	12	0	67	31	-5,300	E LAKI / WOCE
8	16-Mar	2	25	0	0	25	0	0	INS Problems
9	17-Mar	2	94	0	0	94	0	0	RadarSat
10	28-Mar	3	3	0	0	3	17	-21,100	S LAKI
11	29-Mar	3	1	0	1	2	1	-7,800	SW LAKI
12	30-Mar	3	95	3	0	98	25	0	RadarSat
13	1-Apr	3	0	0	1	1	0	0	AC Problems
14	2-Apr	3	14	0	0	14	9	-33,800	E LAKI
15	3-Apr	3	10	0	0	10	0	0	Radar Problems
16	10-Apr	4	0	0	0	0	1	0	In Transit
17	11-Apr	4	4	1	0	5	16	3,900	S LAKI / Bergs Outside LAKI
18	12-Apr	4	1	3	0	4	5	-8,700	SW LAKI
19	15-Apr	4	53	1	0	54	8	0	SE LAKI
20	16-Apr	4	2	0	0	2	19	0	WOCE
21	17-Apr	4	0	1	0	1	19	-3,200	Visual Patrol / WOCE
22	24-Apr	5	1	0	0	1	30	-1,900	S LAKI
23	28-Apr	5	104	0	0	104	0	0	WOCE
24	29-Apr	5	9	1	1	11	3	0	SE LAKI
25	1-May	5	12	0	0	12	6	-19,000	S LAKI
26	8-May	6	0	0	0	0	14	-16,400	S LAKI
27	9-May	6	0	0	1	1	2	0	E LAKI
28	10-May	6	9	9	0	18	0	0	S LAKI / SLAR Inoperable
29	12-May	6	4	0	2	6	12	0	S LAKI
30	13-May	6	1	0	0	1	2	-22,100	SE LAKI
31	14-May	6	0	0	15	15	0	0	WOCE / RadarSat
32	23-May	7	3	0	3	6	0	0	S LAKI
33	24-May	7	7	0	3	10	31	0	E LAKI
34	26-May	7	13	1	0	14	6	-13,200	SE LAKI
35	27-May	7	7	0	3	10	47	0	
36	28-May	7	3	0	0	3	0	3,900	S LAKI / Autopilot Failure
37	8-Jun	8	4	0	12	16	20	-27,300	S LAKI / WOCE
38	9-Jun	8	7	0	0	7	0	0	S LAKI / Radar Inoperable
39	10-Jun	8	8	0	7	15	7	0	W LAKI / Radar Inoperable
40	11-Jun	8	2	0	1	3	0	0	E LAKI
41	12-Jun	8	9	0	1	10	23	-31,400	S LAKI
42	13-Jun	8	8	0	5	13	9	0	W LAKI
43	24-Jun	9	7	18	2	27	0	0	S LAKI / Turbulence
44	25-Jun	9	8	5	6	19	8	-17,000	S LAKI
45	26-Jun	9	1	0	5	6	11	-22,300	E LAKI
46	30-Jun	9	1	1	7	9	0	9,700	W LAKI
47	9-Jul	10	14	7	4	25	1	21,200	S LAKI / 7 Growlers Outside
48	13-Jul	10	1	1	1	3	8	-8,800	W LAKI
49	16-Jul	10	0	0	0	0	0	0	S LAKI / SLAR Inop / WOCE
50	17-Jul	10	6	0	2	8	6	-18,600	S LAKI
51	25-Jul	11	8	10	0	18	2	0	RadarSat
52	26-Jul	11	4	0	0	4	2	-31,700	E LAKI
53	27-Jul	11	1	0	0	1	3	-8,900	W LAKI
54	28-Jul	11	27	2	0	29	2	0	RadarSat
55	30-Jul	11	3	0	2	5	4	700	S LAKI
	Totals:		769	80	89	938	418	-298300	
	Averages:		14	1	2	17	8	-5424	

Figure 1

1997 IIP RECDET EFFECTS ON LAKI



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